

How to accelerate home renovations through innovative financing

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April 2023

This report has been commissioned by BEUC. However, views and opinions expressed do not systematically reflect BEUC's own conclusions.

Published in April 2023 by BEUC
BEUC-X-2023-038



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Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EISMEA. Neither the European Union nor the granting authority can be held responsible for them.

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1. Glossary

CAEs: Energy Efficiency Certificates for buildings in Spain

CBI: Clean Bonds Initiative

DSO: Distributor System Operator

EE: Energy Efficiency

EED: Energy Efficiency Directive 2012/27 (amended in 2018)

EPBD: Energy Performance Buildings Directive

EPC: Energy Performance Contracting

ESA: Energy Service Agreement

ESCO: Energy Services Company

ESI: Energy Savings Insurance

FTG: Filling The Gap package

GBI: Green Bond Issuance

HBS: Household Budget Survey

KfW: Owned-state development and investment bank in Germany (Kreditanstalt für Wiederaufbau)

LHF: Low Hanging Fruit package

MUB: Multi-Unit Buildings

PACE: Property Assessed Clean Energy programmes

SFH: Single Family Houses

STW scheme: Short-time work scheme

2. Executive Summary

Over 90% of the European building stock was already built in 1990, before most of the countries had energy performance requirements in place. Thus, the amount of capital needed to address renovation is huge, far outweighing public resources. Innovative channeling and financial engineering are needed to accelerate the energy renovation rate, currently lagging behind in Europe.

This report explores how to foster home energy renovations through innovative financing mechanisms. The document has five main sections:

- First, the **state of art of energy renovation in the residential sector** is analysed, focusing in four countries Germany, Italy, Spain, and Poland. The quantitative research has been enriched with the insights from the interviews held with relevant stakeholders (further information about these interviews are contained in 9.2).
- Second, an **analysis of possible financial instruments** is presented. The section delves into the pros and cons of grants, on-bill, PACE (Property Assessed Clean Energy programmes), EPC/ESA (Energy Performance Contracting and Energy Service Agreement), Green Bonds, Energy Efficiency Obligations and Guarantees. Furthermore, an example and a summary of the lessons learnt from real-life experience is provided for each form of financing. Insights from the interviews in this topic complete the analysis.
- Third, the suitability of each instrument (and potential combinations) is tested using a scoring method based on relevant criteria and objective indicators or performance. The test has been conducted separately for the two segments under consideration: the Low Hanging Fruit (LHF) – investments below €1,500 in low-income houses that significantly increase the comfort of a dwelling and the Filling The Gap segment (FTG) – in-depth energy efficiency (EE) renovations in middle income houses covering up to 20% of the financing. Results show that complementarities and synergies among the instruments can mitigate most of the weaknesses that emerged on the individual assessment of each instrument.
- Fourth, as result from the suitability analysis, a **financial model** based on the mixed contribution from energy suppliers and local authorities is selected. This mixed model is analysed identifying the stakeholders involved in the scheme and the requirements needed for the implementation. Then, the eligible measures and a step-by-step explanation of the model operation is provided. A variation of the model has been designed to better respond to the needs of the LHF. Finally, a third model is presented introducing the Distributor System Operator (DSO) in the scheme with a facilitator role as an alternative to reinforce the stability of the scheme. From the financial perspective, all models include the on-bill component (although in the LHF is limited to the repayment of the financial costs of the measures) and grants to improve the returns on investment for the energy suppliers. A window is left open to financing through commercial banks, which can also tap on green bonds issuance (GBI) for refinancing. A Guarantee Fund is also key to balance the default risk and generate investment's confidence. The final pieces of the puzzle are the local authorities, which promote the renovation program among citizens; and the Energy Obligation Schemes, which introduce the right incentives for energy suppliers and DSOs.
- The final chapter summarises the barriers identified for the implementation of the financial model and the policy recommendations necessary to overcome the barriers. Some recommendations constitute requisites for the success of the implementation: creation of a National Plan for energy renovation and the Guarantee Fund or the grant's allocation. The others are oriented to improve the framework for smoother implementation. Figure 1 shows the relationship between the suggested policy recommendations and the barriers they address:

POLICY RECOMMENDATIONS	BARRIERS				
	Insufficient consumer awareness	Low-income consumers associated with high credit risk	Lack of interest from energy suppliers	Lack of reliable information	Limited resources of local authorities
National plan to incentivize energy retrofits	✓		✓		✓
Creation of a guarantee fund		✓	✓		
Revision of the EED			✓	✓	
Engagement strategy at local level	✓				
Statistics and reliable precise data	✓			✓	
Grants for vulnerable consumers	✓	✓			
Regulate the concept of “homeowners’ association”		✓	✓		
Development of the framework for GBI			✓		

■ Requirements for the implementation of the financial instrument
■ Recommendations for a smoother implementation

Figure 1. - Policy recommendations per barrier

3. Introduction

3.1 Context

The European Consumer Organisation - BEUC is the umbrella group for 46 independent consumer organisations from 32 countries. Its main role is to represent them to the European Union (EU) institutions and defend the interests of European consumers, ensuring that the EU takes policy decisions that improve the lives of consumers.

BEUC has hired Creara to carry out a study to identify appropriate financial instruments to stimulate home energy retrofits and renovations.

The study shall analyse existent financial solutions and their combination, providing arguments to raise engagement among consumer organisations, supporting BEUC's and its members' advocacy work towards consumer's protection and renovations. The study focuses on the following EU countries: Germany, Italy, Spain and Poland.

3.2 General information

The EU's building stock is ageing. Over 40% of the European building stock was built before 1960 and 90% before 1990. Considering the residential building stock with and Energy Performance Certificate (EPC), almost 75% is energy inefficient and requires renovation. As of 2022, only 22% has grades of A or B. As a result, nearly 40% of the total final energy consumption and 36% of greenhouse emissions in the EU is linked to the EU's building stock¹.

The first energy performance regulations started appearing in Europe in the 1970s, therefore an significant amount of the building stock was constructed without any energy performance requirements. Since that year, several European regulations regarding the energy performance of buildings have been issued.

The most recent regulation is the Energy Performance of Buildings Directive (EPBD 2018/844), which establishes minimum energy efficiency criteria for newly constructed buildings and aims to accelerate and support the renovation of the existing buildings. In 2021, the European Commission proposed a new EPBD to ensure the achievement of the environmental goals by 2050.

The EPDB 2018/844 introduces a new set of standards for the assessment of the energy efficiency of buildings, the family ISO 52000. The standards establish an overarching methodology, that aims to determine the energy performance of buildings. Performance criteria must be established by each country, with values within the established threshold.

From a consumer perspective, the new set of standards ISO 52000 establishes new thresholds for the buildings' energy performance labels, along with the new methodology that professionals' certifiers must apply. However, not all European countries have adapted their national methodologies to the ISO 52000 standard. Among the countries of study, only Spain has fully adopted those standards.

3.3 Statistics

All the data used in this report are gathered from official sources of the European Union and independent centres of expertise on energy performance of buildings. Those include, but are not

¹ European Commission (2013), [EU Building Factsheets](#)

limited, to the Buildings Performance Institute Europe (BPIE) reports, Joint Research Centre (JRC) reports, the statistical office of the European Union (Eurostat) database and European Commission projects.

The year 2020 presents clear shifts in the obtained values for each of the analysed indicators. During the years 2020 and 2021 there have been impactful events, the effect of which is not limited to those years, but that are also shaping the current situation. The COVID-19 pandemic influenced the residential market, especially in the choice of households to rent or own their dwelling. The following energy market crisis as of mid-2021 produced increases in the arrears on utility bills, as well as the increase of the energy poverty.

The foreseeable trend is impacted by the direct and indirect consequences of these events. Additionally, in 2022, Europe has been affected by the war in Ukraine. The economic sanction imposed on Russia by the European Union and the limited supply of natural gas by Russia has increase the impact of the ongoing energy crisis. As a consequence of all these events, we can identify the overall rapid increase of inflation in Europe, and the increase of interest rates introduced by central banks, which restricts access to loans due to the rise of the financial costs. In addition to the challenges mentioned above, the residential market must adapt to the increasingly demanding requirements imposed by the new EPDB and its respective transpositions in the Member States. Energy efficiency requirements create obligations on the real estate market, which must absorb the extra costs related to energy efficiency interventions.

Due to the limited data, and the strong influence that the observations made in 2020 and 2021 have had on the following years, it is hard to determine if these values are mere outliers, or if they represent a long-lasting change in the trend. An in-depth study of the cause-and-effect relationship is out of the scope of this report, however.

The limited, updated information that can be encountered about the energy performance of buildings, as well as the recent shocks on the trends that have the highest impact on the market, makes less predictable the future development. Nevertheless, the assumptions made during the study are based on official and reliable reports, which leads to realistic conclusions.

Observing the average EU variation of households by tenure status, income, type of dwelling, and arrears on utility bills, it can be concluded that after 2020, the growth rate is tending to come back to levels before that year. However, in absolute terms, the influence of the values in 2020 is still visible.

4. Overview of the residential sector in the selected countries

4.1 Germany

4.1.1 National Context

In Germany, the first legal requirements for energy efficiency in buildings was passed in 1976. Almost 75% of the residential building stock in Germany was built before 1970 and, therefore, without any energy efficiency requirements. On average, each Multi-Unit Buildings (MUB) has seven apartments².

Since the 1976, there have been several changes in the regulation specially to address EU-wide regulations such as the SAVE act from 1993. More recently, the transposition of the EPBD 2018/844. Which adds the “Nearly Zero Emissions Buildings” concept.

The current regulation in force was approved in 2020, with an expected review in 2023. Even though Germany is a federal state, the Energy Performance of Buildings requirements were implemented nation-wide and developed by the National Organization for Standardization (DIN) which launched the set of standards DIN V 18599. Additionally, Germany has set technical obligations for building systems. As an example, the reform introduced in March 2022 to the Building Energy act obliges to install heating systems that are sourced with energy coming from at least 65% renewable sources by January 2024. It means that already in 2023 there is a need to install half a million heat pumps. This poses a challenge, both from the supply and demand side, and a potential bottleneck in the access to heat pumps.

In Germany, the total floor area of the residential buildings is almost 69% of the overall building stock. This percentage is below the EU average (78%), even though Germany is the most populated country in the EU. In terms of distribution by building type, there is a close equilibrium between single-family houses (SFH) and MUB, as the share of the latter amounts to 55%³.

The risk of poverty or social exclusion in Germany is of 21.6%, slightly over the EU average value of 21%⁴. This factor is primarily related with social issues, not energy ones, as Germany has been pushing on the notion of energy poverty since the concept emerged. The households that are in risk of poverty are the ones that have an equivalised disposable income below 60% of the national median equivalised disposable income after social transfers. Social exclusion is related to material and social deprivation, due to an enforced lack of necessary and desirable items to lead an adequate life.

Regarding the excessive energy consumption, 17.4% of households spend more than twice the national median on energy expenditure. The EU average for this metric is slightly lower, at 15%⁵. This metric is taken from the 2015 Household Budget Survey (HBS), and has not been updated yet, as the Energy Poverty Advisory Hub does not have the access to the microdata that would allow replicating the calculation.

In 2022 Germany approved a one-off payment of €300 for all employed people that pay income tax. Additionally, families receive a one-time bonus of €100 per child, doubled for low-income households. For this purpose, Germany will employ €65bn⁶. However, there are no non-transitory grants to tackle energy poverty. Since 2008, Germany has a special programme to train unemployed people as qualified energy efficiency advisors and employ them to offer free consultancy and advise to households in a situation of energy poverty⁷.

² Episcopo (2016), [Residential Building Typology Germany](#)

³ European Commission (2013), [EU Building Factsheets](#)

⁴ Eurostat (2020), [Persons at risk of poverty or social exclusion by age and sex](#)

⁵ Energy Poverty Advisory Hub (2022), [Energy Poverty, National indicators](#)

⁶ Bundesregierung (2022), [The third relief package](#)

⁷ Strompar-check plus (2022), [Federal Ministry of Economics Initiative](#)

4.1.2 Quantified residential sector

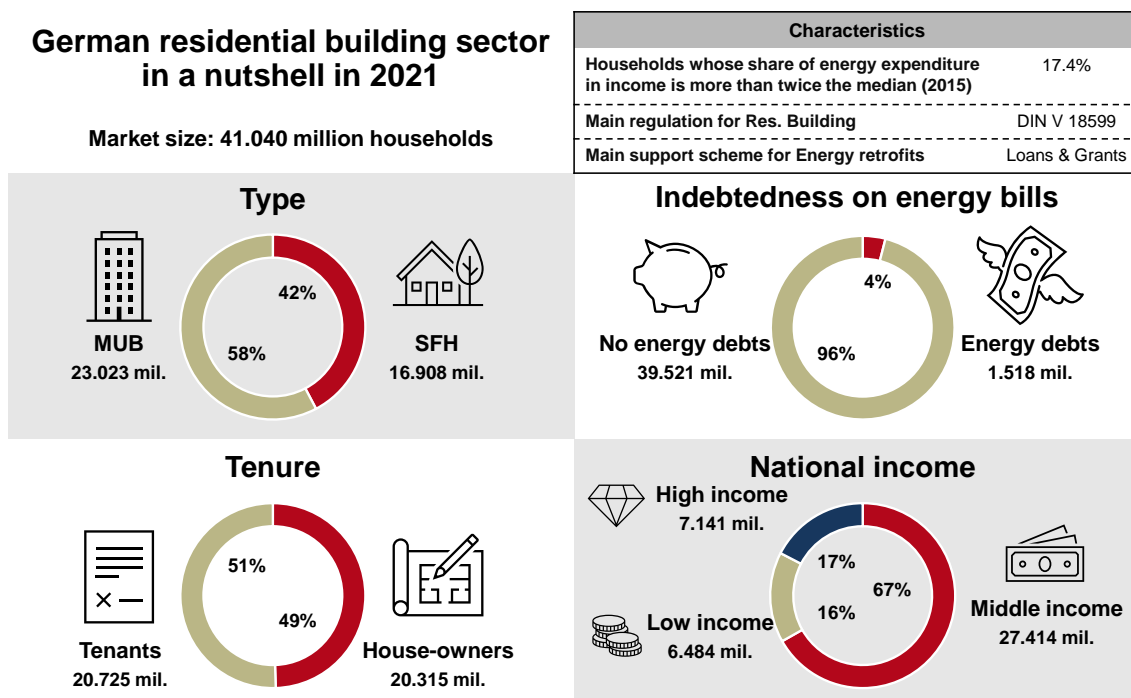


Figure 2. - German residential building sector in a nutshell

Regarding energy-related retrofits, Germany is the country with the highest investment of the EU in the residential sector, between 2012 and 2016. In terms of euros invested per m² renovated, Germany remains among the 10 countries with highest investments, but it falls from the top of the list. However, in relative terms considering the age of the buildings stock, Germany is getting behind compared to their European partners: Germany achieves only a renovation rate average of 9.8% between 2012 and 2016, against an EU average of 12% for the same period⁸. The reason is that 75% of the residential building stock was constructed prior to 1970⁹, and therefore the relative effort that Germany must do is greater. To understand the context, it is needed to evaluate the evolution of the distribution of households by tenure, type of dwelling, income and indebtedness.

Figure 3 shows that until 2020, there was a clear trend of transfer from the low-income group towards the middle-income group. This was disrupted in 2020, but already in 2021, the situation came back to the previous trend. In 2021, almost 16% of the households had low-income status, while the majority, almost the 67%, belonged to the middle-income group. Due to the COVID-19 pandemic there were important changes in the median income, that affected all countries in the European Union. Germany had over a 4% loss in the median income, which negatively affected the number of households considered middle-income, also there have been an increased turnover rate. After 2020, wages have come back on track and there are more employment vacancies¹⁰.

⁸ European Commission (2019), [Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU](#)

⁹ European Commission (2013), [EU Building Factsheets](#)

¹⁰ Eurostat (2020), [Impact of Covid-19 on employment income](#)

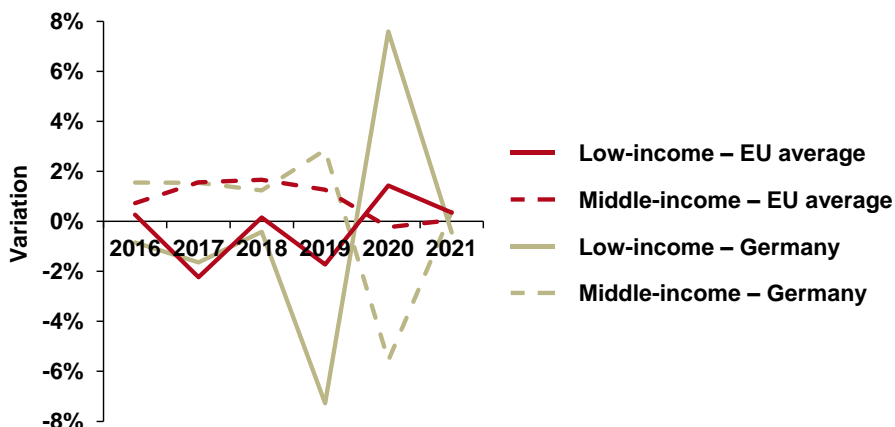


Figure 3. - Variation of households by income in Germany and EU average¹¹

Figure 4 shows the behaviour of the last key indicator considered in the study is the delay in payments of utility bills. For 2021, only 4% of the population living in Germany had delays in payments, whereas the EU average was 6%. Of this 4%, around 30% of households in arrears had incomes below 60% of the median. This shows that the value for 2020, even though it is a very high variation, does not mean a great change. The value range is so small than even a small change, in this case an increase from 2.2% to 3.3% in relative terms, can provoke a spike in the variation. However, it may prove the lack of a proper safety net for the households with the lowest income, as there is a significant impact during the crisis on these households¹².

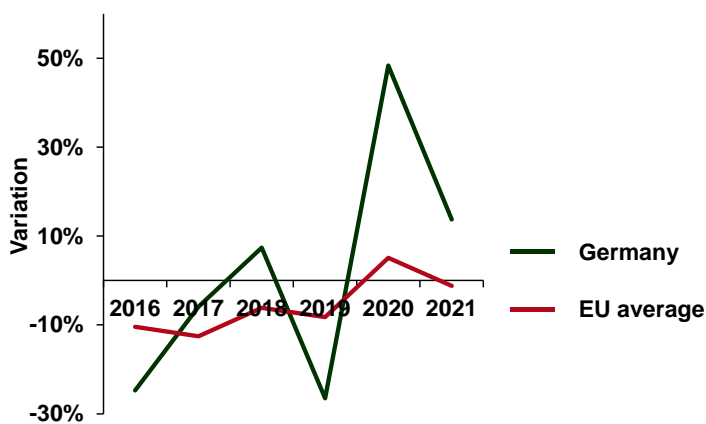


Figure 4. - Variation of households with delays in payment of utility bills in Germany and EU average¹³

¹¹ Eurostat (2022), [Average household size](#)

¹² European Social Policy Network (2021), [Social protection and inclusion policy responses to the Covid-19 crisis. Germany](#)

¹³ Eurostat (2022), [Arrears on utility bills payment](#)

4.2 Italy

4.2.1 National Context

In Italy, the total floor area of the residential buildings is almost 90% of the overall building stock, the highest value in the EU. In terms of distribution by building type, Italy is one of the countries with highest share of MUB, 74%, only second to Estonia¹⁴. On average, each MUB building counts four apartments¹⁵.

In 1991, Italy issued the first legal requirements for energy efficiency in buildings. 51% of the residential building stock in Italy was built before 1970, and 82% before 1990, therefore, without any energy efficiency requirements. Since then, Italy has implemented the new EU-wide regulations, like the most recent, the EPDB regulation from 2018.

The current regulation in force in Italy was approved in 2020. The requirements in terms of energy performance of buildings are supported by technical standards published by the Italian Unification Agency (CTI). Even though currently it is applied the standard UNI 11300, the CTI has set up a technical committee to transpose and publish a new standard, based on the ISO 52000.

The risk of poverty or social exclusion in Italy is of 25.3%, it is over the EU average value of 21%¹⁶. Relating this factor to the energy market, in Italy 16% of the households have a high share of energy expenditure in income. This metric represents the proportion of households whose share of energy expenditure in income is more than twice the national median. The EU average for this metric is similar, 15%¹⁷. The fact, that Italy as a higher value than the EU average may be counterintuitive, as the period of highest energy consumption, usually, is winter. Even though Italy is known for its mild winters, it is true mainly for the south areas, while the heavily populated northern parts of the peninsula are in another climatic zone and affected by the mountains.

Since 2020 Italy provides a Power Bonus for Economic Hardship, directed to low-income households and middle-income households if those comply with some conditions. This public grant provides a maximum help of €260 on the payment of the energy bills and is issued at a national basis by the Italian government. For low-income households and middle-income households with four or more children can the bonus has a one-year duration and can be enlarged by presenting a proper document at the end of the period. For middle income households with four children, the right to the bonus ends in December 2022. There is no specific measure to combat energy poverty, aside the energy bill grant, however Italy participates in the ENPOR project, and it is expected to tailor policies specific to the Italian context¹⁸.

¹⁴ European Commission (2013), [EU Building Factsheets](#)

¹⁵ Episcopo (2016), [Residential Building Typology Italy](#)

¹⁶ Eurostat (2020), [Persons at risk of poverty or social exclusion by age and sex](#)

¹⁷ Energy Poverty Advisory Hub (2022), [Energy Poverty, National indicators](#)

¹⁸ ENPOR (2022), [Pilot policies](#)

4.2.2 Quantified residential sector

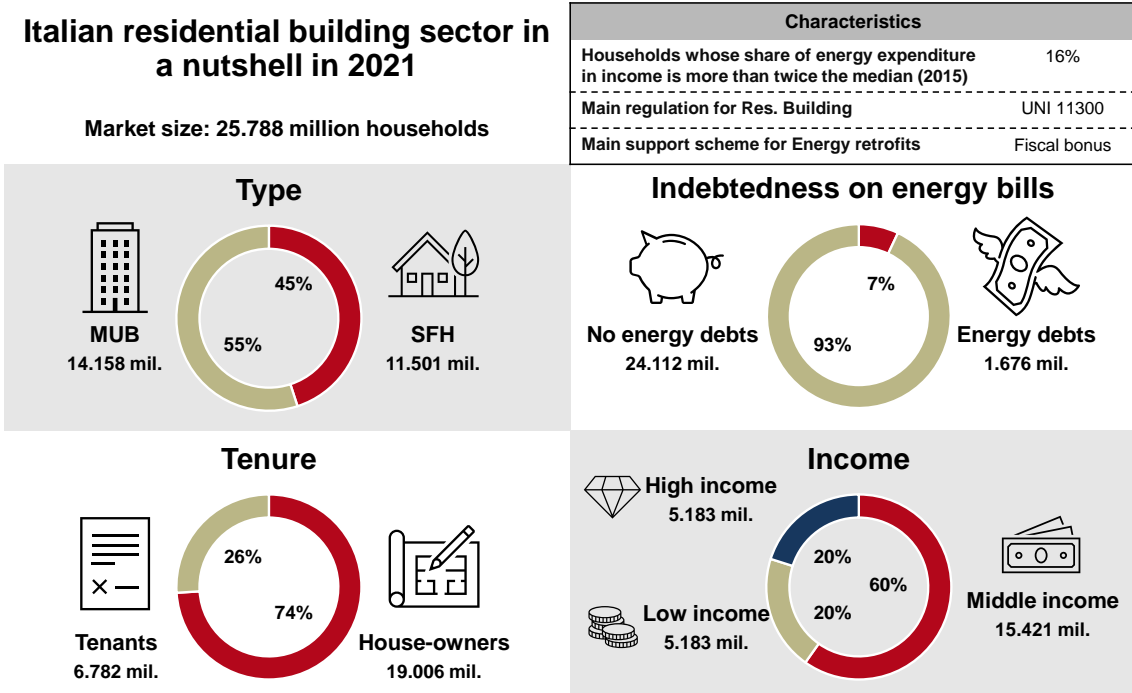


Figure 5. – Italian residential building sector in a nutshell

Regarding energy related renovations in the residential sector, between 2012 and 2016, Italy achieved a 13.7% average total annual energy renovation rate, where the EU average for the same timeframe was 12%. In the same years, an average of €62 per m² was invested in renovations in Italy; a value that is also the median of the EU¹⁹. The main measure to incentivise energy retrofits in residential buildings is the Super Bonus scheme. A special tax credit that can be accessed after performing energy related renovations. The beneficiaries can subtract the cost of the works from their tax returns over a five-year period. They may also deduct an additional 10%, intended to cover bank interest. As the currently available statistics do not include periods after 2016, there is no clear view of the effects so far.

Figure 6 shows that there is a clear transfer from low-income households to middle-income from 2017 until 2020. The EU average exhibits a similar behaviour. However, this has been disrupted 2021 when almost 21% of the households have low-income status, while the majority, almost the 60%, belong to the middle-income group. It is difficult to assess the reasons behind these shifts. However, one main reason for them are the changes produced by COVID-19 pandemic. Italy was one of the countries with biggest decrease in median income, with an over 7% decline²⁰. They did not recover from this shock in 2021.

¹⁹ European Commission (2019), [Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU](#)

²⁰ Eurostat (2020), [Impact of Covid-19 on employment income](#)

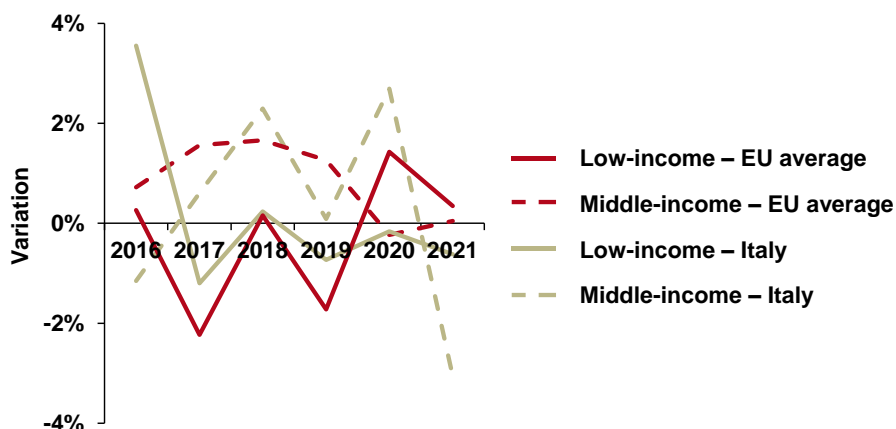


Figure 6. - Variation of households by income in Italy and EU average²¹

The last indicator that is been taken into consideration, is the delay in payments of utility bills. In 2021, 7% of the population living in Italy had delays in payments, whereas the EU average is 6%. Of this, 7% of households in arrears have incomes below 60% of the median. It may be assumed that the effect of COVID-19 on the labour market, produced that many of the newly unemployed people decided to stop paying the utility bills. Additionally, the price spike in 2021 made it more difficult for households to make ends meet, which is showed by an increase in indebtedness. However, the price spike influence was lower than in COVID-19, as in 2021 the labour market started to stabilise²².

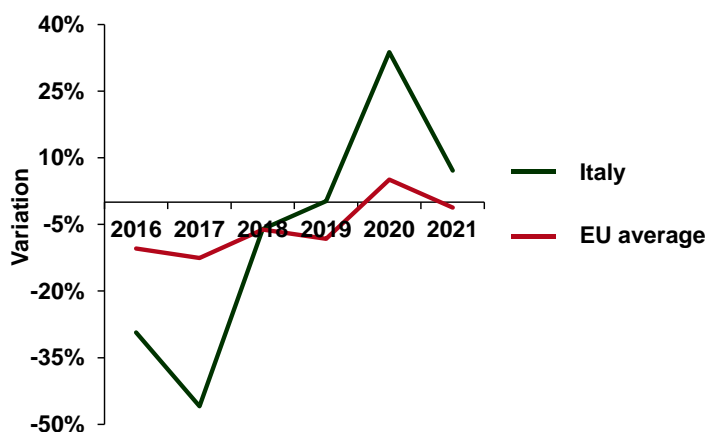


Figure 7. - Variation of households with delays in payment of utility bills in Italy and EU average²³

²¹ Eurostat (2022), [Average household size](#)

²² Eurostat (2020), [Impact of Covid-19 on employment income](#)

²³ Eurostat (2022), [Arrears on utility bills payment](#)

4.3 Spain

4.3.1 National context

In Spain, the total floor area of residential buildings is around 83% of the overall building stock, whereas the EU average is 76%. In terms of distribution by building type, Spain is one of the countries with the highest share of MUB, 71%, only behind Estonia and Italy²⁴. On average, each MUB building counts seven apartments.²⁵

In 1998, Spain issued the first legal requirements for energy efficiency in buildings. 31% of the residential building stock in Spain was built before 1970, and 61% before 1990, therefore, without any energy efficiency requirements. Since then, Spain has implemented the new EU-wide regulations, like the most recent, the EPDB regulation from 2018.

The current regulation in force in Spain was approved in 2021. Complying with the EPBD 844/2018, Spain bases the requirements for newly constructed buildings on the standards series ISO 52000. Additionally, the deep renovations of the thermal envelope have to comply with the new standards.

The risk of poverty or social exclusion in Spain is 26.4%, which is over the EU average value of 21%. Relating this factor to the energy market, in Spain, 14.2% of households spend more than twice the national median on energy expenditure²⁶. This metric represents the proportion of households whose share of energy expenditure in income is more than twice the national median. This is a slightly lower value, if compared with the EU average (15%)²⁷. The short, mild and dry winters are the main reason for lowering the needed expenditure in the energy bills for households. Only the northern regions of Spain have a different climate zone, but they are not as heavily populated as the southern parts of the country.

The flagship measure of Spain to combat those indicators is the Electric and Thermal Social Bonus. Those are public grants, reflected as discounts on energy bills. Energy companies charge an additional fee to 'non-vulnerable' households. This fee is included in the electricity bill, and it is used to fund and sustain the Social Bonuses. For households with low resources, the subsidy can reach even 40% of the energy bill. Due to the COVID-19 pandemic and subsequent energy market crisis, this value has been increased up to 80% of the energy bill, at least until the end of 2023. Households benefiting from this social aid programme are protected against any additional charges the energy supplier may make, such as contracting additional services, and have simplified bills in which all the relevant information must be clearly explained.

²⁴ European Commission (2013), [EU Building Factsheets](#)

²⁵ Episcopo (2016), [Residential Building Typology Spain](#)

²⁶ Eurostat (2020), [Persons at risk of poverty or social exclusion by age and sex](#)

²⁷ Energy Poverty Advisory Hub (2022), [Energy Poverty, National indicators](#)

4.3.2 Quantified residential sector

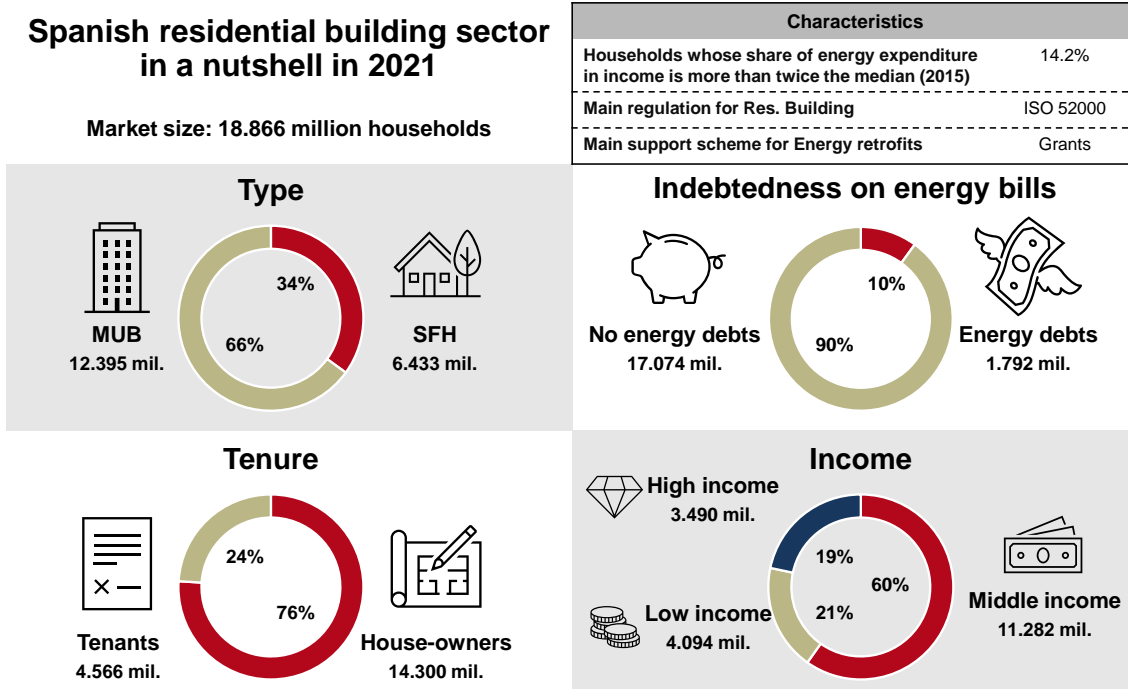


Figure 8. - Spanish residential building sector in a nutshell

In terms of energy related renovation rates, between 2012 and 2016 Spain achieves 17% average total annual energy renovation rate, whereas the EU average for the same timeframe is of 12%. In the same years, Spanish households invested an average of €46 per m² renovated, a value that is below the EU median (€62/m²)²⁸.

Until 2020, there was a clear trend of transfer from the low-income group towards the middle-income group. However, this was disrupted in 2020 and in 2021 the difference was even greater. In 2021, almost 21.7% of the households had low-income status, while the majority, almost the 60%, belonged to the middle-income group. One main reason for the differences regarding the mean European values is the pandemic. The Spanish STW scheme, ERTE, has greatly reduced the number of people suffering from layoffs, with over 2.7 million employees registered to obtain ERTE benefits in April 2020²⁹. Therefore, the decrease in median income has not been as severe as in other countries³⁰, though it was sufficient enough to decrease the number of households considered high and middle income.

²⁸ European Commission (2019), [Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU](#)

²⁹ European Network of Public Employment Services (2021), [PES measures and activities responding to Covid-19](#)

³⁰ Eurostat (2020), [Impact of Covid-19 on employment income](#)

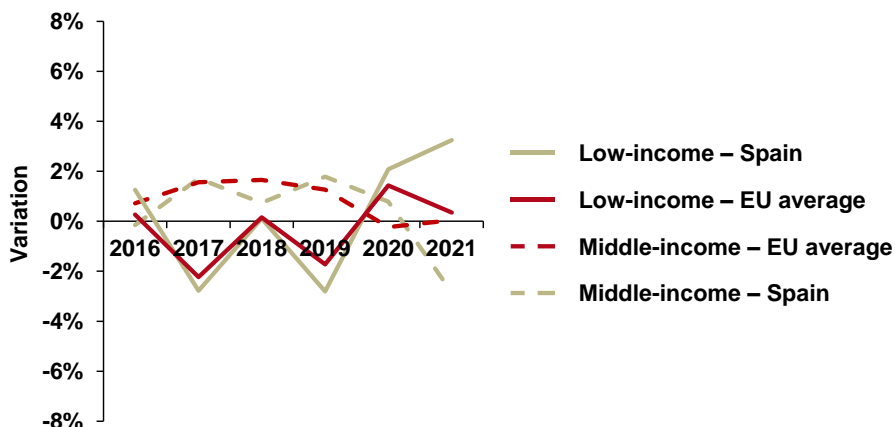


Figure 9. - Variation of households by income in Spain and EU average³¹

Regarding the delay in payments of utility bills, 9.6% of the population living in Spain has delays in payments, whereas the EU average is 6%. There was a great increase from 6.5% to 9.6% in 2020. Of this 9.6%, around 54% of households in arrears have incomes below 60% of the median income. Although Spain managed to reduce the decrease in median income, the long lockdown period and dependency on ERTE benefits increased the number of households that had troubles in paying their utility bills. The recovery process after the pandemic was fast enough stop the positive variation in arrears on utility bills³².

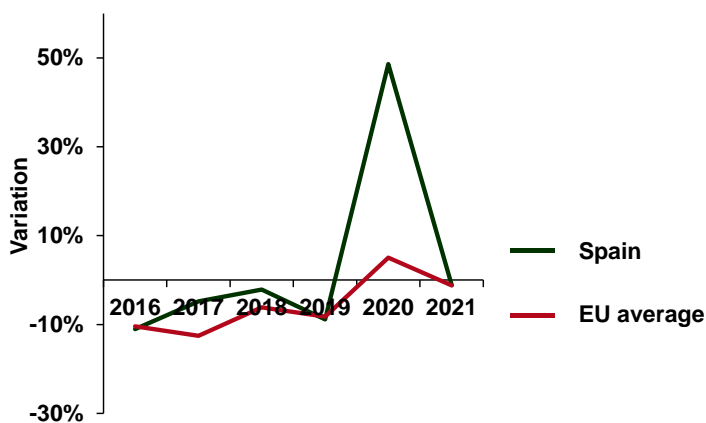


Figure 10. - Variation of households with delays in payment of utility bills in Spain and EU average³³

³¹ Eurostat (2022), [Average household size](#)

³² European Network of Public Employment Services (2021), [PES measures and activities responding to Covid-19](#)

³³ Eurostat (2022), [Arrears on utility bills payment](#)

4.4 Poland

4.4.1 National context

In Poland, the total floor area of the residential buildings is around 67% of the overall building stock, where the EU average is 76%. In terms of distribution by building type, Poland one of the countries with highest share of MUB, 67%, only behind Estonia, Italy and Spain³⁴. On average, each MUB building counts 10 apartments³⁵.

One of the key characteristics to understand the Polish residential market, is that the owners of flats in MUBs are highly concentrated. In Poland, each of the MUBs belong to a MUB community. This community may concentrate even whole city districts and is entirely managed by an administration team. The high amount of households that conform each of the MUB communities reduces greatly the financial risks that the financial institutions need to bear, as the whole community is held responsible for the financial liability. This allows even low-income households to access meaningful renovations, even if they have bad credit ratings.

In 2002, Poland issued the first legal requirements for energy efficiency in buildings. 42% of the residential building stock in Poland was built before 1970, and 90% before 2000, therefore, without any energy efficiency requirements. Since then, Poland has implemented the new EU-wide regulations, like the most recent, the EPDB regulation from 2018.

The current regulation in force in Poland was approved in 2022 but will come into force in March 2023. Additionally, the Polish government has required every landlord to provide information about the heating technical systems in every building in the country. For this purpose, in 2022 the government has created a dedicated database, the Central Registration of Building Emissions (CEEb).

The risk of poverty or social exclusion in Poland is 26.4%, it is over the EU average value of 21%³⁶. Relating this factor to the energy market, in Poland 16.3 % of the households have a high share of energy expenditure in income, a similar value compared to the EU average³⁷. Poland is a country with cold winters and fewer hours of sunlight during the year, compared with other countries in the study. The need for increased heating and lighting increases the expenditures in energy in terms of income. Even though Poland has one of the lowest electricity prices, the purchase parity median income is also relatively low.

Since 2013, Poland has implemented an Electricity Bonus, directed to the low-income households. This bonus was revised in 2021. Even though by itself the Electricity Bonus only grants around €5 per household member, it allows the households to apply and receive additional support in other governmental actions. Additionally, during 2022, the Polish government granted an additional help of €400 to low-income households in energy poverty affected by the increase in prices in the last year.

³⁴ European Commission (2013), [EU Building Factsheets](#)

³⁵ Episcopo (2016), [Residential Building Typology for Poland](#)

³⁶ Eurostat (2020), [Persons at risk of poverty or social exclusion by age and sex](#)

³⁷ Energy Poverty Advisory Hub (2022), [Energy Poverty, National indicators](#)

4.4.2 Quantified residential sector

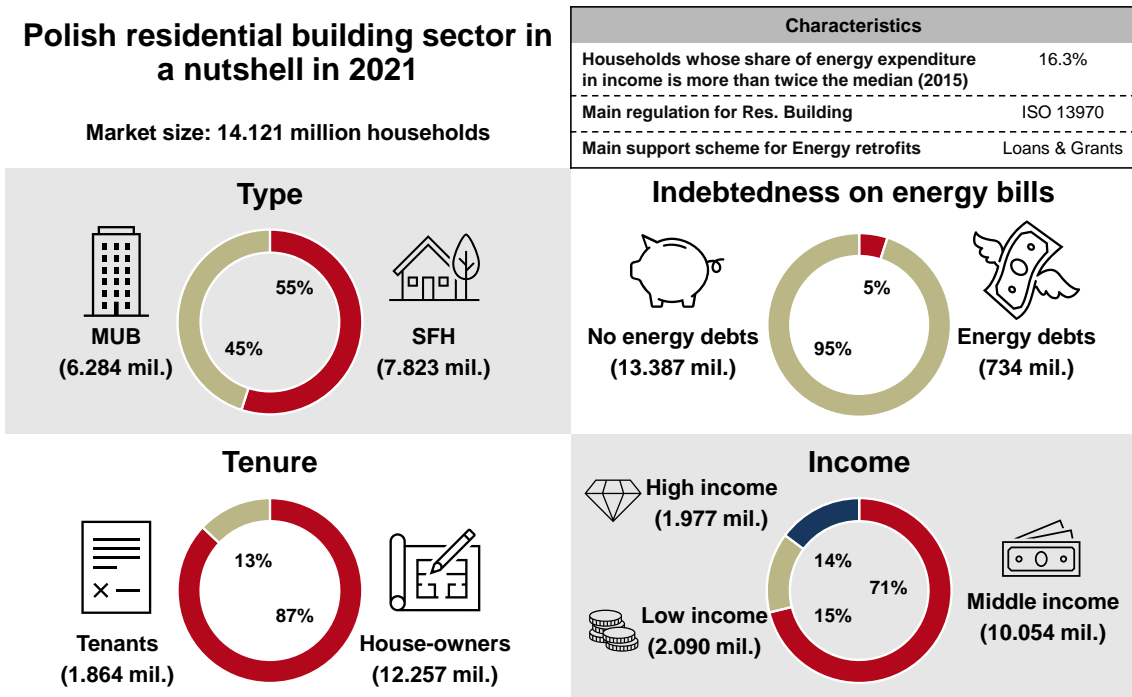


Figure 11. - Polish residential building sector in a nutshell

In terms of renovation rates, between 2012 and 2016 Poland achieves a 17.4% average total annual energy renovation rate, where the EU average for the same timeframe is of 12%. In the same years, Poland invested on average €55 per m² renovated, a value that is below the EU median (€62/m²).

Until 2019, there was a clear trend of transfer from the low-income group towards the middle-income group. In 2020, in contrast to the EU average, the number of low-income households decreased. In 2021, 14% of the households have low-income status, while the majority, almost 71%, belong to the middle-income group. In the countries of study, Poland has experienced the smallest decrease in median income due to the pandemic³⁸. However, it must be considered, that Poland has the lowest median income, compared to the countries in the scope of the study. Middle-income households were the most affected.

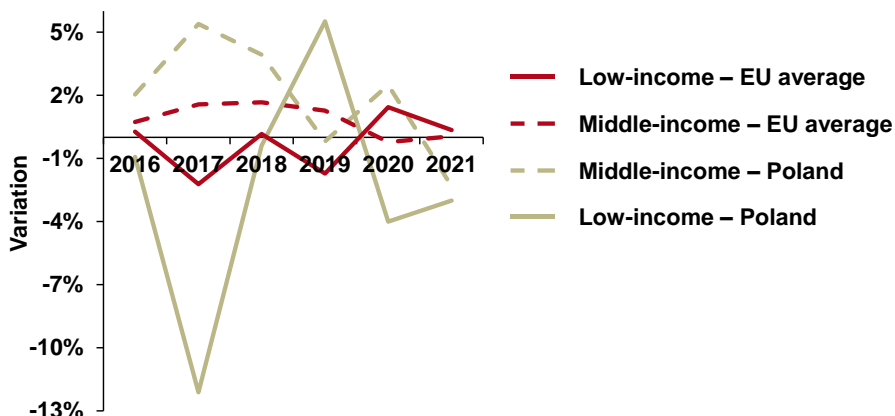


Figure 12. - Variation of households by income in Poland and EU average³⁹

³⁸ Eurostat (2020), [Impact of Covid-19 on employment income](#)

³⁹ Eurostat (2022), [Average household size](#)

Only 5% of households in Poland had delays in payments of utility bills in 2021. This value is below the EU average (6%). Of this 5%, around 36% of households in arrears have incomes below 60% of the median. Poland is the only country, compared with the countries in the scope of the study, that had reduced arrears on utility bills in 2020. The reason is that most of the impact produced by the pandemic was in 2021, rather than 2020. The special social aid programmes ended by the end of 2020⁴⁰.

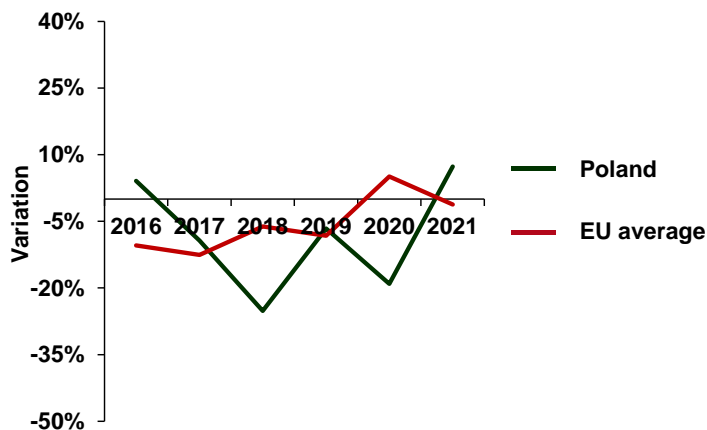


Figure 13. - Variation of households with delays in payment of utility bills in Poland and EU average⁴¹

⁴⁰ European Social Policy Network (2021), [Social protection, and inclusion policy responses to the COVID-19 crisis Poland](#)

⁴¹ Eurostat (2022), [Arrears on utility bills payment](#)

4.5 Qualitative information

To better understand the national context and their challenges, experts from each country have been asked to provide insightful views about the residential building market. Table 1 summarises their answers. The summary of all the interviews held can be find in the Annex 9.2.

Characteristics	Germany	Italy	Spain	Poland
Current financial instruments for home renovations	<ul style="list-style-type: none"> The current financial scheme grants more funds as the certified energy savings increase 	<ul style="list-style-type: none"> The renovation scene in Italy has been totally dominated by the Superbonus in the recent years 	<ul style="list-style-type: none"> Grants have prevented the development of other innovative financing solutions 	<ul style="list-style-type: none"> The current loan & grant system is in place since 1998 and it is a great success, especially in thermal modernisations
Need for innovative financing	<ul style="list-style-type: none"> The shifts in tenure condition are creating a new challenge for the retrofit market 	<ul style="list-style-type: none"> The market needs another mechanism, as the Ecobonus lacks real traceability of the credits 	<ul style="list-style-type: none"> An attempt was made to introduce the PACE scheme, but due to the necessary regulatory changes this was not possible 	<ul style="list-style-type: none"> The current model is efficient for the current need. However, the long-term retrofit KPIs will not be reached
Risk mitigation mechanisms	<ul style="list-style-type: none"> The financial scheme is developed by the KfW on behalf of the public authority, therefore there is no need to mitigate risk 	<ul style="list-style-type: none"> As the current main scheme consists in a tax credit, there is no real risk to be mitigated. 	<ul style="list-style-type: none"> The stakeholders have confirmed the necessity of a guarantee fund to reduce financial costs and make home retrofits more affordable 	<ul style="list-style-type: none"> Homeowners' associations act as private guarantee funds

Table 1. - Summary of the insights provided by the national experts

4.6 Conclusions

The COVID-19 pandemic and subsequent energy crisis have had a substantial impact on the European residential building market. Current events – war in Ukraine, energy crisis, inflation and restricted access to loans exacerbate the increase on energy prices. As a consequence, arrears on utility bills have risen. Other trends such as the shift from SFH to MUB are shaping the residential building market (additional statistics on the variation of tenure status and building type are available in the annex 9.1). These circumstances influence the scope of possible financing models for energy renovations, narrowing down the choices.

Traditional financial instruments are sensitive to the changes and may increase the associated financial costs for consumers, as happens with commercial bank loans. Addressing up-front costs, creating a community of consumers to reduce risks and restrict the intervention on the market became key aspects to be considered. There is a need for an innovative financial instrument that would solve these common problems.

5. Analysis of individual financial instruments

According to recent research⁴², the picture of financing instruments for energy efficiency among EU countries is quite diverse. While financial instruments for home renovation have achieved certain degree of market penetration in Germany, Italy and Spain, they are still at developing stage in other EU countries.

Standard financial approaches (grants and loans) are the most common practice in EU countries, but innovative mechanisms such as Energy Performance Contracting, on-bill, on-tax or green mortgages are becoming increasingly relevant⁴³.

In the next subsections, a selection of the main financing instruments and their characterisation is provided.

5.1 Grants

Grants are public financing instruments typically tailored to property owners (homeowners and landlords) which, provided certain requirements are met, can access to financial support to renovate their homes. Most EU countries have government-backed programmes that disburse resources at local or state level, which often draw from EU funds. However, for a variety of reasons (lack of sufficient communication, stringent up-front capital needs and bureaucratic hurdles to mention a few) these funds are not always optimally disbursed.

- Pros:
 - **Affordability for consumers:** Grants are the cheapest way to finance home renovations from a consumer standpoint, which, and for certain renovation in low-income families the unique access to renovation. Grants reach large sections of society that are often excluded from other sources of funds (i.e.: home equity or borrowed debt).
 - **Useful for policy makers:** Grants are perceived by policy makers as straightforward mechanisms with low entry costs; they are easily implemented, and regulatory changes are normally not needed. In addition, grants are useful for policy makers to prioritise certain technologies or energy measures in order to cope with their sustainability goals. Finally, grants have been quite effective creating a demonstration effect when subsidies are used to pilot building renovations in large neighbourhoods.
 - **Immediate impact:** Grants directly fill on an immediate financial gap, enabling a temporary shift in the market.
- Cons:
 - **Non-self-financing:** Experts agree on the impossibility to cover the massive renovation needs exclusively by public grants. Other sources will have to be tapped to meet the renovation pace set by EU targets for emissions, energy savings and overall sustainability.
 - **Bureaucracy:** The complexity of the bureaucracy that often accompanies grant applications is enough to discourage some potential beneficiaries. Remarkably, in some countries like Spain public funds for renovations are systematically not exhausted due, to a large extent, to the barriers created by the complexity of the application process.
 - **Up-front costs:** Grants are often designed as ex-post reimbursement instruments, which in practice means that consumers need to have the up-front

⁴² REFINE Project (2021), [Refinancing Market Assessment Report](#)

⁴³ BPIE, Ecologic Creara and Climact (2020), *Financing renovation – Factsheet (Legislative and non-legislative policies)*

capital to embark on renovations. This is challenging for low-income consumers, while high income consumers disproportionately benefit from the public support.

- **Market distortive effects:** Undesirable effects due to the lack of incentives to seek for the most cost-efficient solution may occur (technology providers may seek to take the most advantage of the subsidy, topping the price regardless of the real cost of the measure).

On top of that, applicants are sometimes led to ask for measures that do not make economic sense. In addition, there is the so-called rebound effect (underperforming of the energy improvements because of inefficient behavioural responses due to the lack of incentives to keep an efficient use of the new technologies). The case of the Ecobonus scheme in Italy is a good example of how fraud and unjustified price increases may occur⁴⁴.

Characteristics	Energy efficient refurbishment from the Federal Fund for Efficient Buildings in Germany managed by KfW (Kreditanstalt für Wiederaufbau)
Type of instrument	KfW provides a loan for existing houses, with a % of repayment grant that varies depending on the level of efficiency achieved ⁴⁵ .
Impact	From 2005 until 2016, the refurbishment of around 2,595,000 dwellings was supported through the KfW CO2 Building Renovation Programme in Germany (which has been the umbrella programme for this grant). With fluctuations, the trend of renovations is growing steadily (RenOnBill, 2020). On the other hand, the underlying principle of the deeper the renovation the higher the repayment fee, should favour impact energy measures.
Maturity/ Penetration	Similar programmes have been in place in the country since 2002. One of the limitations is that the programme is only accessible for homeowners. A survey on building owners regarding energy renovation of the building envelope and heating system showed that only 27% of the respondents made use of public support programmes (Dena, 2016).
Self-financing and market basis	It is, in essence, a soft loan with a repayment grant, therefore market principles partially apply.
Scope of financing/ Residential adequacy	The grant is designed for the renovation of existing real estate for greater energy efficiency and is therefore adequate for the residential sector.
Affordability for consumers	Reimbursable amounts range (depending on the efficiency level) from €6,000 to €37,000. Maximum credit amount around €150,000. Grace period is from 1-5 years. Tenure goes up to 30 years (with 10 years of fixed interest). Reduced interest rates are granted.

⁴⁴ This information has been verified during the interviews held with Italian stakeholders.

⁴⁵ In the context of this grant, efficiency house is an energy standard for residential buildings. The values 40 to 85 define the different efficiency house levels.

Risk mitigation options	The bank usually requires a collateral (for the loan part); the specific form and scope of collateralisation is agreed during credit negotiations between the borrower and the financial institution.
Other considerations	According to the above-mentioned survey from Dena, in terms of penetration, the public support programmes did not have a great performance. Despite grants are preferred over loans or mixed instruments, bureaucracy, lack of knowledge about the support schemes and low interest rates offered by commercial banks at that time were the main deterring factors.
Links of interest	Grant for energy refurbishment KfW soft loan

Table 2. - Example of grant instrument

- Lessons learned

Overall, grants in the renovation context must be designed to allow a more effective use of public resources, which means considering the following points:

- One of the main issues encountered analysing the performing of these types of instruments in EU countries was that instead of targeting energy poverty or typologies of neighbourhoods, they were more based on the readiness of the recipients whether they are individuals or public bodies or municipalities.
- A positive example of a programme designed to cover energy poverty is stop smog in Poland. The program is for municipalities / cities with more than 100,000 inhabitants and that have a problem with air quality. Stop smog gives a 100% subsidy to low-income citizens for the replacement of high-emission heating sources and envelope's improvement through insulation in residential buildings connected either to the heating or gas network.
The residents have to submit an application (sign a contract) to the municipality, and they take care of the rest of the formalities. During nearly two years of the programme, over 50 million of PLN 1.2 billion was spent, approximately 4% from the budget of the programme and 1,000 single-family houses benefited.
- The establishment of national revolving funds can help to bridge the gap between the scarcity of public resources and the need to provide long term for renovation at reasonable prices. For instance, by means of re-deploying resources from ESI (Energy Savings Insurance) fund, which allows energy service providers to access to a long-term funding source at more favourable market conditions, and banks to allocate money in the fund.

5.2 On-bill schemes

On-bill schemes are a method of financing energy efficiency improvements that use the energy bill as the repayment vehicle for the investments made in energy efficiency measures. This mechanism has been in place in USA for more than 30 years and has invested over \$2bn in total, of which 60% went to residential buildings⁴⁶. Despite its potential, on-bill schemes have hardly been explored in Europe.

Among other advantages, on-bill schemes are interesting because they incorporate the energy supplier, whose direct access to energy users is key to solve the fragmentation issue of the residential market, to the centre of the renovation scene. However, certain obstacles of different nature continue to hamper the adoption of on-bill instruments in Europe.

A subtype of on-bill includes the Distributor System Operator (DSO) in the scheme, which can help overcome some barriers. The repayment vehicle shifts to the DSO charges which solves the transferability issues. On top of that, in contrast to energy suppliers, DSOs are only one (or a few) in each country which makes the scheme implementation more efficient. Engaging the DSO in an active role as promoters of the energy efficiency programmes might be difficult, since their activity has been traditionally limited to ensuring the proper functioning and efficiency of the distribution. Thus, a model that envisions DSOs as mere facilitators, cooperating with the energy suppliers to encompass the repayment for the energy efficiency measures in the DSO charges seems more realistic. The model with DSO as facilitator is further explained in section 7.3.

A more detailed explanation of the advantages and disadvantages follows.

- Pros:
 - **Affordability for consumers:** If bill neutrality is achieved, energy efficiency measures are performed at no extra cost for consumers⁴⁷.
 - **Simplicity:** Consumers directly pay the EE measures or renovations through the energy bill. The simplicity of this method is a clear advantage for the consumer compared to borrowed debt or grants.
 - **Energy supplier as creditor:** Signing up an on-bill offer does not imply indebtedness in the strict sense. For many consumers, relying on energy suppliers to renovate their homes sounds more appealing than dealing with bank loans.
 - **Better credit options:** Connected to the point above, when banks enter the scheme (as in certain subtypes of on-bill), they give credit directly to the energy supplier. Normally, when credit conditions are negotiated at corporate level, better options are offered than those set for individual consumers.
 - **Behaviour change:** On-bill schemes open the way to programmes that aim at supporting consumers engage in behavioural change. As in performance contracts, the savings (and therefore, the earnings) will be greater when the technologies work as expected, thus, the end user is incentivised to optimise their behaviour.
 - **Easier targeting of the residential sector:** The residential sector is often disregarded by financiers due to its level of fragmentation (atomised market, low investment volumes). Energy suppliers are in a better position to face this problem; consumers constitute their client base, and they already have a great amount of valuable information about their energy consumption which facilitates market segmentation and other means to maximise the impact of marketing campaigns.

⁴⁶ RenOnBill project (2021), *Overview of RenOnBill Building Renovation Scheme*.

⁴⁷ Bill neutrality is met when projected energy savings offset the fixed periodic fee to repay the energy investment. By these means, consumer does not pay higher bills than before the interventions and, once the pay-back period of the energy supplier is reached, consumers will entirely benefit from the savings.

- **New opportunity for energy suppliers:** Energy suppliers are given the opportunity to diversify by entering the profitable business of renovation while meeting the energy saving objectives required by law and improving their image of sustainability.
- Cons:
 - **Relatively unknown instrument:** Being a relatively new, on-bill still quite unknown in Europe, which raises some scepticism among stakeholders. Energy efficiency measures are typically associated to ESCO, or in case of deep renovations, to construction companies, therefore linking this activity to energy suppliers sounds new and unproven. In reality, the on-bill model has been mainly used in the EU to finance small efficiency measures with good returns on investment. Energy suppliers and DSOs seem less interested to launch on-bill programmes for deep renovations. Only the example of Brussel's Sibelga could be found, which succeeded in replacing coal-based heating with gas boilers.
 - **Uneasy collateralisation:** Although theoretically possible, collateralisation can be challenging. Disconnection is out question; most of the stakeholders consider that is not unacceptable. In most EU countries, disconnection is legally limited to a few scenarios and vulnerable consumers are protected⁴⁸. Other possible collaterals need contractual arrangement (i.e.: insurance, personal guarantees). Despite this situation, most energy suppliers do not seem discouraged since the default rate is relatively small. Homeowners' associations have proven to be good payers (level of liability among co-owners is high).
 - **Transactional costs:** Certain subtypes of on-bill schemes which introduce banks and ESCOs in the model, may carry high transaction costs, by the simple fact that the value change may become disproportionately long for the size of the investments.
 - **Other barriers:** On top of that, certain barriers to on-bill mechanisms persist. First, the tenant owner dilemma⁴⁹. Second, the transferability of the repayment obligation derived from an on-bill intervention in case of a sale or rental contract or in the event of a change of tenant. Finally, energy suppliers may also be forced to find a way around limitations stemming from credit laws that tend to reserve credit activity for banks.

Characteristics	SUNSHINE Project in Latvia
Type of instrument	The main actors involved in the schemes were the ESCO and a fund which finances the interventions. The special facility (LABEEF) was set for the forfeiting receivables from EPCs to reduce the debts on ESCOs' balance sheets. Repayments for the renovations are made via a building services' supplier bill. Renovations are oriented to save energy but also to improve the home comfort (non-energy benefits).
Impact	The project successfully enabled 31 projects across Latvia, adding €25.5m of investments, to be scheduled for implementation. LABEEF has for instance forfeited a portfolio of six buildings from project partner RenEsco. The fact that the project seeks "non energy benefits" is an important factor to increase the impact of the renovations.

⁴⁸ According to the findings of RenOnBill, disconnection works more as a psychological threat than a real collateral.

⁴⁹ The owner-tenant dilemma occurs when the landlord provides the tenant with the housing, appliances, and installations but the tenant pays the energy bills. The landlord does not want to invest too much money in energy efficiency while the tenant wants to lower the energy costs (Ástmarsson et al., 2013).

Maturity/ Penetration	Used since 2018. According to research conducted by REFINE project in 2021, the scheme is already in the process of being implemented in some EU countries, including Poland, Austria and Bulgaria and its replication explored in others, such as Italy, Spain, Portugal and France.
Self-financing and market basis	The combination of EPC and forfeiting generates cashflows that can be reinvested in the programme. Nevertheless, EBRD and long-term private investors have already invested in the scheme, seeking long-term sustainable returns (REFINE, 2021).
Scope of financing/ Residential adequacy	The programme was conceived to support the necessary massive refurbishment of the Latvian building stock, which was mostly built during the Soviet period with poor energy standards. Multi-family residential buildings can benefit from this scheme (structural & aesthetic measures are eligible and encouraged).
Affordability for consumers	Tenors higher than 20 years. The cost is predominantly linked to the client's creditworthiness. Additional costs are minimised through a high level of standardisation of the proceedings and operation.
Risk mitigation options	The obligations are linked to the property, not to the owner. The performance risk after implementation remains with the ESCO or can be transferred to a third party, subject to approval by the facility. There is building insurance: for the amount no less than the restoration value of the building with minimum insurance coverage against fire, earthquake, flood, water damage, any other natural disasters. Performance guarantee provided by the ESCO.
Lessons learnt	The greatest advantage of this mechanism is to provide financing for a larger set of benefits (such as health and comfort) aside from reduced energy. The main difficulties encountered in rolling out the program were related to the legal framework, and specifically to the insufficient transposition of EU directives.
Links of interest	Sunshine

Table 3. – Example of on-bill instrument

- Lessons learned

Overall, on-bill financing is a flexible instrument with high potential to overcome some typical barriers, specially related to financing aspects. However, the implementation of on-bill financing needs some fine tuning to succeed in the EU context.

- On-bill schemes can work well in combination with other instruments. For instance, in Italy, one energy supplier has used on-bill to finance the measures that were not covered under the Ecobonus, allowing their customers to go deeper on renovations without the need to bear the up-front costs.
- According to the experience gained in Sunshine, although in principle adding new parties to the scheme (the external financing, the ESCO, the insurer) could diminish the profitability of the investment, high levels of standardisation can offset those extra costs.

5.3 PACE

On-tax instruments are government measures intended to encourage homeowners to renovate by reducing the amount of taxes that they have to pay. In practice, on-tax incentives can be applied as a deduction in the personal income tax or a rebate in the real estate property tax.

PACE (Property Assessed Clean Energy) constitutes a type of on-tax incentive that allows property owners to repay their renovation costs over a period through property tax bills, being the payments secured by the property itself⁵⁰. In most of the cases, financing came from private sector although states had to pass different regulations to allow PACE development. Below are the main pros and cons of on-tax instruments:

- Pros:
 - **Affordability for consumers:** Owners can implement improvements without a large up-front cash payment.
 - **Large-scale implementation:** PACE has the potential to reach a large range of consumers through a single instrument. In addition, placing the municipalities at the cornerstone of the model allows to cope with the goals set by municipal energy plans.
 - **Non-transferability issues:** When the debt is tied to the property (as in the case of PACE) as opposed to the person, the traditional transferability issues (who is responsible for the debt if the property is sold) are solved. By these means, the repayment obligation may transfer with property ownership if the buyer agrees to assume the PACE obligation and the new first mortgage holder allows the PACE obligation to remain on the property.
 - **Collateralization:** In addition, the level of securitisation (financing is attached to the property), makes affordable financing possible even for low- or medium-income holders.
- Cons:
 - **Limited replicability:** Requires high legal and administrative set-up obligations and changes of regulation. According to research conducted by the EuroPACE Horizon 2020 project, all EU countries would have to amend their legislation to some extent to implement on-tax financing. On top of that, launching and managing on-tax programmes can be high demanding of resources at municipal level.
 - **Tenant-dilemma:** Tenants are, in principle, excluded from the scheme.
 - **Other barriers:** Potential resistance can be expected from lenders/mortgage-holders whose claims to the property may be subordinated to the unpaid assessment amount should the property go into foreclosure.

Characteristics	EuroPACE Project in Spain
Type of instrument	EuroPACE project aimed to boost home renovation through on-tax financing using real estate taxes as repayment vehicle. In addition, the program offered technical advice, support, and verification. A risk-sharing facility was created to provide access to credit for vulnerable people. A non-for-profit foundation was created to manage the project for the following reasons: 1) The foundation does not consolidate with the municipality's balance sheet thus limiting the city's exposure; 2) Preferential fiscal treatment due to non-profit status; 3) Positive social perception and community engagement; 4) Eligible to receive subsidies and donations; 5) Ability to act as a social platform to raise awareness, tackle energy poverty, and support vulnerable groups.

⁵⁰ U.S Department of energy (2022), [Property Assessed Clean Energy Programs](#).

Impact	In 2018, the PACE market in the US surpassed \$6bn in funded projects, including the retrofit of over 220,000 homes, which resulted in more than 50,000 new local jobs and the creation of hundreds of new companies (<i>Scalable innovative Financing for Smart buildings, Smart En</i>). In Europe, EuroPACE intends to save 3.5M MWh/year by 2025. For every €1m invested in energy efficient renovation, the project would generate 18 jobs (direct and indirect) in Spain.
Maturity/ Penetration	PACE in the US and EUA (Environmental Upgrade Agreements) in Australia are already consolidated financing schemes for renovation. In Europe, under EuroPACE a pilot was launched in Olot and has inspired other renovation programmes (Fithome , Regenerate and Opengela).
Self-financing and market basis	Beneficiaries from the program repay the loan so the project can be self-financed.
Scope of financing/ Residential adequacy	EuroPACE was born to support homeowners in the renovation journey, to ensure affordable financing and less bureaucratic hurdles. EuroPACE may stay with the property and not an individual in case of sale of the property.
Affordability for consumers	Standardisation and de-risking mechanisms (property attachment and the guarantee fund) helps to ensure affordable financing for a large range of homeowners. EuroPACE covers up to 100% of a project's costs. Tenure can be extended up to 20 years. EuroPACE can be combined with energy supplier, local, state incentive programmes, subsidies and grants. Annual repayments typically do not exceed the energy savings (or the value of generated energy) resulting in a cash-flow positive situation for a homeowner.
Risk mitigation options	Debt is attached to the property. The Social Guarantee Fund is a risk sharing facility that allows the programme to offer affordable loans to vulnerable groups.
Lessons learnt	The link between the property and the financing is key in providing security to investors, which results in a lower cost of financing. All EU countries will require adaptation on their legal systems to implement PACE.
Links of interest	EuroPACE

Table 4. – Example of PACE

- Lessons learned
 - PACE seems a good choice to finance renovations specially when combined with other instruments such as subsidies and grants. However, launching PACE programmes can be complex and costly; they require legal adaptations, as well as extensive negotiations to involve local authorities, which makes their replicability very limited.
 - Attaching these mechanisms to the property itself (as opposed to its occupant) raises the seniority of those payments (and therefore reduces their risk) and should remove them from the relatively high-cost world of consumer finance (bringing them more appropriately into the lower cost world of asset finance).

5.4 EPC/ESA

Energy Performance Contracting (EPC) is a contract between the beneficiary and the provider of an energy efficiency service (ESCO), which implements, verifies, and monitors the energy efficiency implementations, to certify the achieved level of energy efficiency.

In the Energy Services Agreement (ESA) model, the homeowner contracts a service provider to directly purchase energy savings. The source of savings is agreed upon up-front (e.g. lighting improvements) and the service provider works with their customer to design an optimal upgrade. The service provider then funds 100% of the up-front project cost and procures this equipment, installing it at their own expense and, therefore, owns the energy assets⁵¹ (on the contrary, in the EPC model, the new installed technologies belong to the homeowner).

These models are not, in general, suitable for residential. Besides the typical cross-cutting barriers (lack of financing, lack of awareness/information on the potential of energy savings, lack of trained professionals among others), transactional costs are too high for the size of the investments, thus EPC tends to be used rather for tertiary or industrial. Below are the main pros and cons:

- Pros:
 - **Affordability for consumers:** Similarly to on-bill and PACE, EPC solves the up-front investment issue for customers.
 - **ESCOs' expertise:** All processes are normally managed by the ESCOs, which accrue the expertise on energy renovation, energy management and project financing.
 - **Market maturity:** The level of development of the performance contracts has allowed the emerging of several complementary offers such as guarantees and insurance products that help to customise the solution to the real needs.
 - **Behaviour change:** EPC, similarly to on-bill is compatible with consumers' engagement in behaviour change. The savings (and therefore, the earnings) will be greater when the technologies work as expected, thus, the end user is incentivised to optimise their behaviour.
 - **Catalyser of private funds:** These instruments are suitable to mobilise private capital from financial institutions in the energy efficiency market.

- Cons:
 - **Adequacy to the residential sector:** The residential sector might not be adequate for EPC due to the low levels of investment. On the other hand, metering which is central to EPC models is not easy in residential. Energy consumption in households is much more correlated to individual needs than in other sectors. This can make it particularly difficult to define a consumption baseline.
 - **Complexity of the scheme:** In practice, structuring these programs can be quite complex, with several actors (ESCOs, energy suppliers, banks, insurance companies) getting involved and potentially undermining the profitability of the whole scheme.

⁵¹ EaaS vs. ESPC, BetterBuilding Initiative, US Government.

Characteristics	Panel Program in Hungary
Type of instrument	Support in the form of grants and loans for the renovation of prefabricated buildings combined with ESCO model. An EPC with guaranteed was signed between the ESCOs (performing the building renovations) and the housing co-operatives representing apartment owners. Government, municipalities and homeowners were supposed to contribute to the energy efficient renewal of prefabricated buildings by roughly providing one third of total investment costs each. Housing co-operatives typically took a loan to finance energy efficiency investments on behalf of apartment owners. The loan conditions were stipulated based on apartment owners' bank guarantee and ESCOs guarantee.
Impact	About 380,000 flats were partly or totally renovated thanks to this initiative between 2001 and 2009. Their total energy consumption was in some cases reduced by up to 40–50 %.
Maturity/ Penetration	Examples of EPC in residential are scarce, specially based on pure commercial financing. However, mixed instruments like the Panel Program can be found.
Self-financing and market basis	It was a mixed instrument formed by grant, EPC, and loans.
Scope of financing/ Residential adequacy	It was specifically designed for residential, so the model could overcome some barriers.
Affordability for consumers	Total investment needed per apartment oscillated between €6,000 (in case of comprehensive renovation) and €2,000 (in case of partial renovation), out of which owners were supposed to contribute with one third. The loans covered a period from five to almost nine years.
Risk mitigation options	Guarantees linked to the property.
Lessons learnt	Energy savings achieved were in some cases less than expected because apartment owners sometimes preferred to install low-cost solutions. Moreover, the financial crisis caused a credit slowdown and a contraction of ESCO investment in this initiative starting from 2009.
Links of interest	Panel programme

Table 5. – Example of EPC/ESA

- Lessons learned

EPCs and ESAs, are considered risky due mainly to the temporary link of the instrument with the life of the ESCO, which can be very affected by economic or political instabilities. Even in the Czech Republic, Austria, or Spain where the ESCO market is relatively mature, EPC projects in the private sector are less common⁵², mainly due to the specific barriers that affect the residential market as explained above.

- When examples of EPC in residential are found, they work usually in combination with other policy measures (EEOs, on-tax mechanisms or grants).

⁵² REFINE Project, Creara (2021), [Refinancing Market Assessment Report](#).

- Encouraging development trends are being registered in specific market segments where there is the possibility of aggregating the demand⁵³.
- An interesting field of application might be social housing (i.e.: community heating scheme), which are often owned and managed by a central authority, simplifying the model and reducing the costs. Furthermore, ESAs schemes could be considered in such cases, as the volume of investment is relevant, and the refurbishment can be self-financed by means of savings on energy bills⁵⁴.

5.5 Green Bonds

Green bonds are a type of debt issued by public or private institutions that, unlike other credit instruments, are specifically destined to finance green projects. Green bonds are gaining more and more interest from investors, according to some estimates for each €10 from investors willing to invest in green projects only €1 finds a financeable green project.

- Pros:
 - **Scalability through pooling options:** Green bonds can pool with other funds in capital markets, allowing a large level of flexibility.
 - **Ex-post verification:** There are mechanisms in place (post-issuance reports issued by third parties) like the Clean Bonds Initiative (CBI) that allow issuers to track the impact of projects funded by green bonds.
- Cons:
 - **Complexity:** Green bonds are contractually complex. The issuance process requires coordinating with many parties, including credit underwriting and bond reviewers, a burden that can impact smaller bond sales. Thus, a high level of standardisation is needed to make green bonds suitable for residential. The other possibility is aggregation (pooling capital) to compensate for the high transactional costs.
 - **Same interest rates:** On the other hand, the interest rate is based on creditworthiness, which does not necessarily improve because of the green component of the investment (at least not in the short-term).
 - **Only viable for large investments:** Normally, there is a large minimum bond issuance, which represents another barrier for small projects. In the US, green bonds are typically issued for \$10m to \$100m, though they are frequently used to raise larger sums.
 - **Transactional costs:** Reporting proceeding to track the use of funds to verify that they are exclusively allocated to green goals can be time consuming⁵⁵.

⁵³ ESCOs for residential buildings: the market situation in the European Union and policy recommendations, Wolfgang Irrek, Paolo Bertoldi and others.

⁵⁴ RenOnBill project (2021), *Overview of On-Bill Building Energy Renovation Schemes*.

⁵⁵ Marcelo Giugale, (2018), *The pros and cons of Green Bonds*.

Characteristics	OTP Mortgage Bank and green bonds in Hungary
Type of instrument	Green bond backed by mortgages for construction or purchase of used or newly refurbished residential homes, and general-purpose mortgages for renovating and upgrading existing properties subjected to ICMA ⁵⁶ Green Bond Principles.
Impact	5bHUF (1 st tranche in 2021) and 90nHUF (2 nd tranche 2022), equivalent to €120m in total. 45 GWh was the amount annually saved linked to the green bonds.
Maturity/ Penetration	Successful examples of municipalities promoting green bonds to finance sustainability projects can be found. Banks as Unicredit or Hyp Bank are issuing green bonds. However, the application to the renovation of existing houses is very recent; most of the examples of green bond financing are oriented to new construction or commercial buildings.
Self-financing and market basis	It operates as any other bond with the only difference that investments must be linked to certain green principles, there for is a market-based instrument.
Scope of financing/Residential adequacy	It is not easy to find examples of green bonds financing long term renovations. In the case of OTP maximum is 25 years of tenure.
Affordability for consumers	2.5 max interest rate. Maximum 25 years of tenure.
Risk mitigation options	Property as collateral.
Lessons learnt	As in other examples of green bonds, a great investor interest was observed with significant over-subscription. No data other than the energy classification based on Energy Performance Certificates are currently available and as frequently noted, EPCs have issues of reliability, quality and lack of digitalisation. In addition to new housing, emphasis should also be placed on the energy modernisation of the housing stock.
Links of interest	OTP green mortgage and bonds

Table 6. – Example of green bonds

- Lessons learned
 - Data is essential for the success of green bonds as a financing instrument. Whether it is through Energy Performance Certificates or Building's passports (as proposed in the latest EU regulations) needs to be improved in terms of quality, reliability, and digitalisation.
 - Standardisation of green frameworks could improve market transparency and decrease the costs of green bonds financing.

⁵⁶ The Green Bond Principles (GBP) seek to support issuers in financing environmentally sound and sustainable projects that foster a net-zero emissions economy and protect the environment. GBP-aligned issuance should provide transparent green credentials alongside an investment opportunity (<https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/>).

5.6 Energy Efficiency Obligations

EEOs are not in essence a financial instrument; instead, they are a legal provision that, depending on the decision of each EU member on how to comply with it, they can serve as a catalyst for the rolling out of renovation plans. It is a multi-faceted concept and therefore it will not be analysed under the same parameters as the previous financial instruments (from 5.1. to 5.5).

Energy Efficiency Obligations (EEOs) derive from article 7 (article 9 in the upcoming directive) of the Energy Efficiency Directive that requires Member States to achieve a certain level of energy savings in a certain time period, taking into account the need to alleviate energy poverty. In practice, governments must spur energy efficiency investments by setting obligations to energy companies (energy distributors, or energy suppliers) to achieve yearly energy savings. One possible means to implement EEOs could be the introduction of financial instruments for energy efficient home renovations.

- Pros:
 - **Incentives to energy suppliers:** Provides the regulatory push to energy suppliers and other obligated parties to launch renovation programmes. For example, energy suppliers could be incentivised to meet their energy savings obligations by offering on-bill programmes to their customers, providing an additional income stream for renovation programs.
 - **Metrics and projections improvement:** If EEOs have been properly designed, they give a good estimation of the actual savings achieved through the programme.
- Cons:
 - **Complex implementation:** The above-mentioned Article 7 does not establish concrete energy efficiency measures to be accomplished by Member States. On the contrary, each EU country needs to introduce a new regulation to establish mandatory actions. To date, this has led to an unequal level of implementation across the EU. On top of that, launching EEOs programmes can be complex for public authorities, since public resources need to be mobilised.
 - **Potential upward impact in energy bills:** Recent studies ([SocialWatt](#)) found that EEOs can have a negative distributional impact since energy savings are paid by all energy bill payers via a levy on energy bills. Costs raised from energy bills are more regressive than those raised through income taxation (the additional costs on energy bills creates a higher burden for low-income households than those on higher incomes).
 - **Lock-in effect:** EEOs have not proven to be useful for deep renovation. Instead of comprehensive renovations, EEOs have focused on individual measures, which are easier to fit into the cost-effectiveness criterion.
- Example: Ireland EEOs scheme for residential (Ireland EEOs scheme)

SEAI is the administrator of the Energy Efficiency Obligation Scheme (EEOS). The scheme started in 2014. It places obligations on large energy suppliers and distributors of electricity, gas or solid fuels (obligated parties) to achieve specific targets of energy savings. For every unit of energy saved through these projects, they achieve energy credits towards their targets.

Homeowners can get support from any obligated party. Insulation, glazing, heating but also advice on energy saving are all considered eligible measures.

The scheme foresees a category for Residential and for Energy Poor (in addition to non-residential). For these credits to be eligible, the post-works BER (national standard of energy performance) must achieve a “minimum BER uplift”. The policy intent is to set the minimum BER uplift at 100kWh/m²/yr in primary energy. The benefit of this minimum requirement is to incentivise

deeper energy retrofits and to further align EEOs with Government targets e.g., retrofitting 500,000 Irish homes to BER B2 standard or above by 2030.

- Lessons learned

EEOs can become an effective instrument to address energy poverty. According to the conclusions depicted by Horizon 2020 programs such as Social Watt and Ensmov, a ringfence around a proportion of the savings target that must be delivered in energy-poor households can be effective. There are though, certain aspects to consider:

- Mechanisms should be considered in the design of the EEO scheme to avoid that only superficial renovation measures are implemented, e.g. by linking the granting of credits to the savings achieved for the final user (verifiable through a standard of efficiency, for example).
- During the implementation of RenOnBill, one of the models that was explored was the use of on-bill to comply with Art 7 so that distributors (by themselves or jointly with the energy suppliers) would comply with their EEO obligations. The idea, although theoretically possible, was not equally well received in all countries, mainly because the degree of implementation of EEOs is not the same across Europe.
- In this sense, EEO must be accompanied by a regulatory development that does not exist in all countries at the moment and that is a clear obstacle for the replication.

5.6.1 Guarantee Fund

Guarantees are, in essence, risk mitigation mechanisms for energy renovation projects. As it normally serves as a complement to a financial instrument, it will not be analysed using the same parameters as in the previous sub-sections (from 5.1. to 5.5).

Different categories exist protecting investors against all kinds of risks (design, component, performance, credit, market or regulatory risks). In practice, it is useful to differentiate between public and private risk (depending on the nature of the guarantee issuer) and technical or credit risk (depending on the type of risk covered).

In practice, energy efficiency investments in low- and middle-income housing would require state-backed guarantees to cover the high risks associated with long payback periods. However, guarantees are not equally distributed across EU. According to research among 11 EU countries on state backed-guarantee instruments, they were only documented in Latvia, where since 2020 a state-owned development financing institution named Altum, offers guarantees for financing energy efficiency projects. In Austria, Greece, and the Czech Republic, public initiatives oriented to provide state-backed guarantees are under preparation. The rest of the surveyed countries do not have any plan or project on this behalf⁵⁷.

- Pros:
 - **Public interest:** State-backed guarantees for renovation can be justified to speed up the CO₂ emissions abatement in the residential sector, and thereby contributing to climate policy objectives.
 - **Positive impact on interest rates:** Guarantees have a potential to foster renovation projects, reducing the interest rate for investors.

⁵⁷REFINE Project (2021), *Refinancing Market Assessment Report*.

- Cons:
 - **Budget constraints:** State-backed guarantees require the mobilisation of public resources.
 - **Complexity:** Guarantees will introduce complexity to the financial scheme, which can have an economic impact leading to added costs of financing for both home owners and promoters of the renovations (depending on the actual distribution of the costs).

- Example: Altum Energy Efficiency in Multi-Apartment Buildings in Latvia

The programme associated to this guarantee aims to promote energy efficiency improvement, smart energy management and the use of renewable energy resources in apartment buildings. Beneficiaries are owners in multi-apartment buildings. The guarantee is extended for a loan provided by a bank, or a loan provided by an alternative investment fund in the amount of up to 80% of the principal amount of financing for a period of up to 20 years.

- Lessons learned

Overall, guarantees can boost projects in the private sector or projects oriented to low-income households or, in general projects that are perceived as risky.

6. Suitability analysis of the financial instruments

6.1 Selected criteria and scoring method

The goal of this task is to conduct a suitability analysis of the financial instruments identified in chapter 5. For this purpose, a criterion has been chosen, defined as a set of qualities that determine the success of financial instruments.

The criteria have been selected from a threefold perspective; the consumer, the market and the supplier, since each of them has a role in the financing process.

Qualities may contain different elements or sub-criteria, which must be assessed separately to better understand the performing of each instrument. Since the analysis must be objective and consistent, indicators are proposed to assess each quality. When possible, quantitative indicators are provided. The application of the indicators will result in three possible values (1, 0,5 or 0).

Then, each value is weighted (in %) depending on the relative importance of the related quality for each package of measures; Low Hanging Fruit – LHF which includes measures from a few hundred to a few thousand euros with better returns on investment (ROI) and Filling the Gap – FTG, destined for deeper and more expensive renovations. Consumers' perspective gets a 50% weighting, market 20% and the supplier's perspective the remaining 30%.

Each instrument and further combinations of instruments will be analysed following this method. Criteria and weighting factors are listed in Table 7. – Scoring system (criteria and weighting) for the suitability analysis. Furthermore, the explanation of each quality is given below:

- The affordability for consumers has a clear effect to encourage home renovations, becoming especially relevant for low- and middle-income homeowners. Two factors are implied: the need to provide up-front money and how costly the financing can become (interest rate borne by consumers).
- The adequacy for the residential market is key to address the specific challenges of these types of investments.
- The residential market is a fragmented one; demand is dispersed and atomised. Financial instruments are often designed for large investments and fail to provide affordable solutions for small projects. To assess this quality, the average volumes of investment handled under each type of instrument will be confronted to those defined for each package (LHF up to €1,500, while that for FTG depends on the country).
- The transferability of the repayment obligation is another factor to be taken into account, especially important for renovations with a long pay back (FTG package). Certain instruments do not present any issue when the property is sold (i.e., when the obligation is tied to the property) while others need some kind of contractual arrangement to provide legal certainty under these circumstances.
- The timeframe to repay for the renovation must be aligned with the payback period of these projects, which tend to be long (more than 20 years for deep renovations). Since the LHF consist mainly in small renovations with short payback periods, this factor is less important for that segment.
- The market-based condition is met when the instrument is able to avoid some negative effects due to the incorrect alignment of economic incentives. Specifically, the lock-in effect occurs when setting insufficient energy performance targets may disincentivise future renovations. Also, public grants may not trigger private investment, having therefore, a limited catalytic effect in renovation. The rebound effect, as explained in sub-chapter 5.1, refers to the underperforming of the energy improvements because of

inefficient behavioural responses. The presence of these negative effects will be the indicator used to assess this quality on each instrument.

- The replicability refers to the potential penetration and market uptake of the financial instruments. Instruments can be attractive or adequate to investors (government, banks, energy suppliers or ESCOs). That is assessed through the demonstrated interest/capacity from suppliers. On the other hand, at a global scale, there are instruments easily adaptable to different framework conditions (legal, social or market related) while others need more or less complex changes in regulatory matters or certain level of market readiness. Finally, scalability, understood as the degree to which the option has been proven (or can reasonably be expected) to finance a significant number of investments, must be considered.
- Self-financing instruments are preferred because they allow long term renovation strategies, increasing the impact. This becomes crucial for the second package of measures, characterised by longer pay-back periods (FTG).
- Risk mitigation options are valuable solutions to increase creditor's confidence in renovations. Guarantee funds but also the collateralisation through the house or the energy asset are possible. Depending on the type of instrument, these options are easy to implement or may require complex arrangements. In some cases (i.e. grants) there is no need for mitigation.

	Qualities	Subcriteria	Indicators	Possible values	Weight LHF (%)	Weight FG (%)
CONSUMER	Affordability for consumers	Upfront costs	Existence of upfront costs	<ul style="list-style-type: none"> No up-front costs (1) Some up-front costs (0,5) High up-front costs (0) 	20	15
		Financial costs borne	Interest rate	<ul style="list-style-type: none"> No financial costs (1) Low interest rate (0,5) High interest rate(0) 	15	10
	Adequacy to residential sector	Ability to cope with market fragmentation (small investment volumes)	Average volume of investment	<ul style="list-style-type: none"> Average investments are in the range of the budget of each package (1, 0,5, 0) 	5	5
		Ability to overcome transferability issues	Level of transferability of the repayment obligation	<ul style="list-style-type: none"> The transferability is intrinsic to the instrument (1) Simple contractual arrangement needed to ensure transferability (0,5) Complex contractual arrangement needed to ensure transferability (0) 	5	10
		Tenure length that allows renovations	Tenure	<ul style="list-style-type: none"> >20 years (1) 10-20 years (0,5) <10 years (0) 	5	10
	MARKET	Market - based	Free of distorting effects	Free of distorting effect (including lock-in effect rebound effect)	<ul style="list-style-type: none"> Two effects avoided (1) One effect avoided (0,5) Not able avoid these effects (0) 	20
SUPPLIER	Replicability	Demonstrated interest/capacity from suppliers	Level of interest and number or issuers potentially interested	<ul style="list-style-type: none"> Very interesting for a wide range of suppliers (1) Medium interest (0,5) Not interesting (0) 	5	5
		Adaptability to diverse framework conditions (legal & policy, economic, market, social)	Level of adaptations required to operate across EU	<ul style="list-style-type: none"> Easily replicable (1) Replicability will require complex adaptations (0,5) Not replicable (0) 	5	5
		Scalability	Can finance a significant amount of investment	<ul style="list-style-type: none"> Very scalable Medium scalable Low scalability 	10	10
	Self-financing basis	Ability to generate cashflows to repay the funds	Cash-flow generation	<ul style="list-style-type: none"> Self-financed (1) Mix (0,5) Not self-financed (0) 	5	5
	Risk mitigation options	Existence/easiness of collateralisation options	Collaterals and complexity of the arrangements needed to lower the risk	<ul style="list-style-type: none"> Collateral exists and is easy to claim (1) Not easy to claim (0,5) Does not exist (0) 	5	5

Table 7. – Scoring system (criteria and weighting) for the suitability analysis

6.2 Results

In a first stage, the scoring method above explained has been applied to the four financing instruments (grant, on-bill, on-tax, EPC/ESA). Below the results obtained:

- For Low Hanging Fruit:

LHF		Grants	On bill	PACE	EPC
Affordability for consumers	Upfront costs	20	20	20	20
	Financial costs borne	15	7,5	7,5	7,5
Adequacy to residential sector	Ability to cope with market fragmentation (small investment volumes)	5	5	2,5	0
	Ability to overcome transferability issues	5	2,5	5	0
	Tenure length that allows the repayment of renovations	5	5	5	2,5
Market-based	Free of distorting effects	0	10	10	10
Replicability	Demonstrated interest from suppliers	5	2,5	2,5	2,5
	Adaptability to diverse framework conditions (legal, economic, market maturity, social)	5	5	0	5
	Scalability	0	10	5	5
Self-financing	The instrument allows the issuer to receive cashflows to repay the investment	0	5	5	5
Risk mitigation options	Possibilities to put in place de-risking measures	5	2,5	5	0
		65	75	67,5	57,5

Table 8. – Suitability analysis for LHF

All these instruments are affordable for consumers. Grants are obviously the most affordable, but they are not market-based mechanisms which lead to distorting effects (already explained in 5.1), difficulties to be scaled (public resources are always limited) and the lack of the self-financing component. In general, public resources will not be enough to cover the renovation needs of the EU residential sector. However, in combination with other instruments, they can be very useful to encourage renovations.

On-bill instruments get the most balanced scoring for LHF. Issues like the lack of transferability and of demonstrated interest from suppliers rise as a medium concern. Although, in theory, on-bill billing could have great potential, energy suppliers have not yet demonstrated a great interest. This problem could be fixed if on-bill programs are anchored in EEOs schemes, imposing obligations for energy suppliers (or distributors) to achieve savings in the final user through energy renovations.

The main problem of PACE is related to the legal complexity of accommodating tax instruments in each national regulation.; i.e, legal frameworks need to be adjusted to enable local authorities to collect the repayment for the energy renovations (via taxes). In addition, the market fragmentation and the lack of demonstrated interest from suppliers are medium concerns.

The inclusion of mechanisms that allow for the aggregation of investments could help solve these problems. In this sense, banks can create packages from projects with a certain level of

standardisation and sell these credit claims in the capital markets. The same role of aggregation can be done by an energy supplier or an ESCO. In this sense, the commercialisation of these credit claims as green bonds could open the door to new sources of refinancing.

EPC/ESA turn out to be the less adequate for residential, with added difficulties to place de-risking mechanisms.

In light of these results, on-bill and on-tax are the best suited for LHF. The table below shows the performance of these instruments. The weaknesses represent aspects that could be improved through the combination with other mechanisms. The intensity of the strength or weakness can be high (++) or mild (+).

	LHF package		
	Strengths	Weakness	How to improve through combination
Grants	<ul style="list-style-type: none"> • Affordability (++) 	<ul style="list-style-type: none"> • Distorting effects (++) • No scalable (++) • No self- financing (++) 	<ul style="list-style-type: none"> • Combination with market-based financing instruments
On-bill	<ul style="list-style-type: none"> • Affordability (+) 	<ul style="list-style-type: none"> • Transferability issues (+) • Lack of interest from suppliers (+) 	<ul style="list-style-type: none"> • EEOs
PACE	<ul style="list-style-type: none"> • Affordability (+) • De-risking options (+) 	<ul style="list-style-type: none"> • Require legal adaptations (++) • Market fragmentation (+) • Lack of interest from suppliers (+) 	<ul style="list-style-type: none"> • Aggregation through Green Bonds Issuance / ESCOs or energy suppliers depending on the size of the municipality

Table 9. – Financial instruments and combinations LHF

- For Filling the Gap:

FTG		Grants	On bill	PACE	EPC
Affordability for consumers	Upfront costs	7,5	7,5	7,5	15
	Financial costs borne	10	5	5	0
Adequacy to residential sector	Ability to cope with market fragmentation (small investment volumes)	5	5	2,5	2,5
	Ability to overcome transferability issues	10	5	10	0
	Tenure length that allows the repayment of renovations	10	0	5	0
Market-based	Free of distorting effects	0	20	20	20
Replicability	Demonstrated interest from suppliers	5	0	2,5	0
	Adaptability to diverse framework conditions (legal, economic, market maturity, social)	5	2,5	0	2,5
	Scalability	0	5	5	0
Self-financing	The instrument allows the issuer to receive cashflows to repay the investment	0	5	5	5
Risk mitigation options	Possibilities to put in place de-risking measures	5	2,5	5	0
		57,5	57,5	67,5	45

Table 10. – Financial instruments and combinations LHF

For this segment, grants, PACE and on-bill achieve the best scoring.

Large investments will normally require the consumer to make some initial disbursement, except for the EPC (ESCOs may bear this cost). Therefore, overall, affordability for consumer's will be lower than for LHF. However, a combination with grants and guarantee funds (the latest aimed to lower the interest rate for consumers) would improve this aspect.

Grants carry the same limitations than in the case of LHF, intrinsic to the non-market-based nature of the instrument.

Encompassed in an on-bill scheme, grants can bridge the gap for those investments that energy suppliers find difficult to finance (i.e. deep renovations that require long payback periods). On the other hand, the lack of interest from suppliers rises as a high concern for this segment. While it is relatively easy to find examples of energy suppliers financing small renovations (boilers replacement), deep retrofits seem out of the scope of energy suppliers' business. As previously explained for LHF, EEOs can provide the stimulus for energy suppliers or DSO to enter in the renovation scheme. That said, it is important to recall here that in those countries with EEOs in place, some downsides have shown up, specifically related to recovery of the costs by the obligation parties via tariffs. For this reason, it might be also relevant to involve energy suppliers in the scheme, so they can play a role promoting the renovations (and in general softening the non-financial barriers). If energy suppliers/DSOs find a supportive partner in municipalities, they might be less reluctant to enter into the renovation business.

On top of that, large investments may encounter certain legal barriers; the lending activity is, in most countries reserved for the banking sector. Energy suppliers financing larges amount of money could be problematic.

On-tax instruments appear to fit better for large investments, but with replicability still being an issue. To cope with the market fragmentation, the same solutions regarding green bond issuance and ESCOs can be proposed here.

EPC again does not obtain a comparative good scoring for this segment.

In light of these results, on-bill, PACE and grants are the best suited for FTG. The table below summarises the main findings. The weaknesses represent aspects that could be improved through the combination with other mechanisms. The intensity of the strength or weakness can be high (++) or mild (+).

	FTG package		
	Strengths	Weakness	How to improve through combination
Grants	<ul style="list-style-type: none"> • Affordability (+) 	<ul style="list-style-type: none"> • Distorting effects (++) • No scalable (++) • No self- financing (++) 	<ul style="list-style-type: none"> • Combination with market-based financing instruments
On-bill	<ul style="list-style-type: none"> • Affordability (+) • Market based (+) 	<ul style="list-style-type: none"> • Financial costs (+) • Tenure length (++) • Lack of interest from suppliers (++) • Potential conflicts with credit law (legal adaptability) (+) • De-risking options (+) 	<ul style="list-style-type: none"> • Grants • EEOs • Guarantee funds • Municipality involvement
PACE	<ul style="list-style-type: none"> • Affordability (+) • De-risking options (+) 	<ul style="list-style-type: none"> • Financial costs (+) • Market fragmentation (+) • Lack of interest from suppliers (+) • Require legal adaptations (++) 	<ul style="list-style-type: none"> • Grants • Guarantee funds • Green Bonds Issuance/ESCOs or energy suppliers depending on the size of the municipality

Table 11. – Financial instruments and combinations FTG

7. Combinations of instruments

7.1 Possible combinations

On their own, all the instruments analysed either have drawbacks or they are not ready-to-use in the current EU energy renovation market. In order to overcome these disadvantages, potential combinations of instruments with added elements have been explored. Specifically, one municipality-based model, two energy supplier-based models, and a mixed energy supplier-municipality that can be described as follows:

- **Municipality-based model:** combination of PACE + ESCO + Guarantee Fund. Although the combination of the on-tax system with guarantee funds has the advantage of reducing financial costs associated with the model, adapting the model to different countries and regions in Europe remains a key barrier to replicability. Therefore, PACE has more probability of success in those countries where political and legal support has been demonstrated (or there is a reasonable expectation).
- **Energy suppliers-based models.** Two possible combinations were analysed:
 - On Bill + Green Bonds + Guarantee Fund
 - On Bill + Energy Efficiency Obligations + Guarantee Fund

In both models, the risk perceived by suppliers would decrease as a result of the de-risking measure (Guarantee Fund). Thus, interest rate would decrease, benefiting consumers. In the first subtype, green bonds create a market of green investments where financiers could easily sell their credits.

In the second subtype, the interest from energy suppliers/DSOs will increase through the EEOs, but scalability and renovation impact would be compromised, since the costs may be ultimately transferred to consumers.

Ultimately, these models rely on energy suppliers as promoters of the renovations. However, in many countries, energy suppliers have not demonstrated enough interest in launching renovation programmes. For this reason, the inclusion of the municipality as in the following model, might be beneficial.

- **Mixed model energy supplier/DSO-municipality:** On Bill + Grant + (Energy Efficiency Obligations) + (Green Bonds) + Guarantee Fund. This model aims to correct the identified market failures with the introduction of the public sector. This model is explained in further detail below.

In contrast to pure energy supplier-based models, in this scheme the local authorities have an active role through two different channels: on one hand, by facilitating the rolling out of the renovation programme through non-financial support (i.e., communication and dissemination to citizens and general support to stakeholders); on the other hand, local authorities will verify the implementation of energy efficiency measures by validating the energy performance certificate upgrade according to the ISO 52000 methodology.

Energy suppliers/DSO (partnering with banks when needed) can assume the financial and technical part of the work. This model may work better under a EEO scheme that incentivises the energy suppliers to collaborate with municipalities to launch energy renovation programmes. The model is compatible with a grant scheme tailored to cover these renovations that the energy supplier will not undertake due to economic reasons.

7.2 Selected model: mixed energy supplier + municipalities

This is a financial instrument, applicable to all types of consumers, combining on-bill schemes with grants, and secured through a Guarantee Fund, that will be capitalised by contributions from all consumers who wish to benefit from the scheme.

This scheme has a specific variant for vulnerable consumers, at risk of exclusion or in a situation of energy poverty, which is based on a rapid response to the basic comfort needs of a dwelling. This scheme relies on the energy supplier for the implementation of the measures, which will be entirely financed by grants awarded to the energy supplier but taking into account the profile of the vulnerable consumer.

Finally, a second variant including the DSO as a facilitator of the financing functioning is analysed. This model has a great potential since it introduces a permanent element in the scheme (the DSO) that can help overcome changes of ownership or energy provider. However, the opposition of DSOs to assume any role related to energy efficiency at consumer level may weaken the model. The number of actors involved and the relationships between them makes it necessary to first present each of them and their motivations. Second, a list including all the requirements needed for this financial instrument to work is shown. Finally, the functioning of each model is summarised. Further information can be found in the Annex 9.3.

7.2.1 Stakeholders

The first step is to identify the main actors in this model and their motivations. Thus, stakeholders can be classified according to their relevance: those that take part in the core financial proposition (in red below) and the rest (in blue), which may have a complementary or enabler role.









	Description	Motivation
Consumers	 Private households	Improve home comfort, value and sustainability
On-bill provider	 Energy supplier providing on-bill services	Deliver savings to comply with national EEOs Diversify and get new clients and image of sustainability
Provider of efficient technologies	 ESCOs, Installers	Increase contract volumes, replicability
Local authority	 Municipalities or similar local entities	Disburse funds. Achieve decarbonization and home renovation targets. Reduce energy poverty
Guarantee Fund	 Self-sustainable fund feed by the contribution of consumers	Reduce the risk perceived by the energy suppliers and create a link between the proposed models
Financial Institutions	 Provide financing for the scheme	Access new market/clients
Refinancers	 Green bonds investors	Increase turnover, diversify
National government	 Government, regulators, etc. which affect in the development of the business model through i.e. EEOs	Achieve decarbonisation objectives, comply with the energy savings targets set at EU level

Table 12. – Stakeholders and motivations

The interactions among these stakeholders will vary according to the package (filling the gap or low hanging fruit), and can be analysed at three levels (core, complementary or enablers). The analysis can be found in Annex 9.3.

7.2.2 Requirements for the introduction of the selected model

Although there are two different variations of the mixed model (energy supplier + municipality model), one for each package (FTG and LHG), when it comes to implementation, the model is conceived as one for the following reasons:

- Economies of scale: the model will become much more efficient.
- The Guarantee Fund is the same for both models; it serves the purpose of securing the investments of middle-class consumers and guaranteeing the repayment of the investments of energy suppliers on vulnerable consumers in a very short period of time.
- Energy suppliers will not be interested in incorporating the LHF variation of the model, as it will not be a relevant source of revenue. Therefore, energy suppliers would need an extra incentive for LHF. This lack of profitability of the LHF segment will be compensated with the revenues generated by the FTG segment.

To implement it, it is necessary to take steps both from a national and a local approach. The cooperation between the different stakeholders plays a vital role. To ensure this cooperation, it is necessary to prepare the ground by fulfilling a set of conditions:

- **Commitments at a national level**
 - **National plan to incentivise energy retrofits:** The first step is the preparation of a national plan, defining the programme and establishing the background information.

First and foremost, it must present the overall model, identifying the stakeholders and reaching out to them to negotiate the specific conditions. The stakeholders need to know that there is a commitment to introduce the necessary regulatory changes that would allow the model to work properly. One key element is the Guarantee Fund, which must be described thoroughly, so there is no doubt about the value it offers as a risk mitigation mechanism. Equally important is to establish the role and tasks of each actor.

The plan shall list and explain the step-by-step implementation process while leaving room for flexibility as the final details should be decided in agreement with the energy suppliers. If EEOs are in place, the negotiation process with energy supplier should be easier. The general model and the adaptations must be clearly set. Accessibility of vulnerable households to the programme must be granted, being an integral part of the model. The plan will contain the list of energy-related renovation measures that are included in each segment alongside the minimum energy savings requisite to benefit from the programme, verifiable through the Energy Performance Certificate. Additionally, obligations and recommendations to energy suppliers to adapt their tools (i.e. Customer platforms) to host the information related to the renovation programme (application, savings achieved, installer's bill).

In addition, it is necessary to define the goals, benchmarks and KPIs that will be observed to control the performance of the programme. The selection of specific criteria, alongside a set of planned next steps would help reassure the energy suppliers about the national commitment and would help reduce the perceived

risks.

The plan should define the allocated funds and link them with their purpose of financing grants and other, non-financial activities that need to be performed by the public authorities.

- **Efficient and widespread system (Energy Performance Certificates):** Complying with EPDB, Member States have introduced national regulations that ensure issuance and registration of Energy Performance Certificates. Changes are expectable to adjust these regulations to the revised (and more stringent) EPDB.

Certificates must include energy saving measures that improve the energy rating in a cost-efficient and technically viable manner. If the certifier is aware that the building is being considered to participate in the FTG model, it is possible to propose the measures that are included in the EE measures list within the energy performance certificate. Thus, the energy supplier further reduces the operational risk, and the public bodies can dispose of more information about the energy performance and the status of the building stock in the country. What is more, the realisation of the energy performance assessment is not expensive, so consumers will not have to bear considerable, additional costs.

All in all, an efficient system of issuing and registering Energy Performance Certificates will make the whole model more robust. It will enable the key players to take more objective decisions and ensuring that the optimal measures are chosen.

- **Creation of a Guarantee Fund:** To reduce the risk borne by the energy suppliers, and thus, reduce the financial costs, a guarantee fund must be created. To ensure the proper legislation is passed, its creation should be clearly stated in the national plan. A key issue here is to decide which would be the fund administrator. Normally a public bank or a public agency at national level is the best suited to assume this role.

The Guarantee Fund operates as a risk mitigation mechanism for the whole model. However, only consumers belonging to FTG will contribute to the fund through the energy bill. This way the self-sustainability of the fund is enhanced. It would cover the risk of default in the on-bill repayment obligation. The process by which the energy supplier recovers the investment in case of default must be clearly defined. If the guarantee fund acts and bears the payment, then the consumer will have a debt with the guarantee fund.

The Guarantee Fund is key for vulnerable households. To ensure the lowest possible financial costs, the risk should be reduced to zero. To achieve this goal, the local authority commits to transfer the grant. There is a risk that the local authority will take too long to make the payment for the measures. Therefore, the national plan should include a special remark, that after a certain short period (i.e., three months) the Guarantee Fund would make the payment to the energy supplier. In that situation, the local authority would have to transfer the grant to the Guarantee Fund. The Guarantee Fund will cover the situation when the grant disbursement takes longer than three months, so the energy supplier does not have to wait any longer. Vulnerable households would be exempted from the contribution to the Guarantee Fund.

Energy suppliers willing to adhere to the program will have to make an initial contribution to the Guarantee Fund. They would have their initial contribution

repaid by the consumers and their payments towards the fund, while the Guarantee Fund would be able to secure the investments.

- **National agreement with the energy suppliers:** Attracting supplier's interest may be challenged by the conflict of interest that may arise, as the operating profit of the energy suppliers will decrease if their customers consume less energy. The national agreement has to address this issue, making it more profitable for suppliers to enrol in the energy renovation programme than other alternatives. For example, assuming the existence of EEOs, the kWh of savings achieved through the renovations must have incentive pricing when traded, so suppliers will naturally opt for this means of complying with their obligations.

The agreement should be signed at a national level, as the negotiation power of the national government is higher compared with municipalities. It also ensures a coherent and consistent framework and rules across the country.

The national plan should draw the grounds for the negotiations with the energy suppliers. During those, the detailed roles and responsibilities of each player have to be defined. Since energy suppliers are knowledgeable of the market, they will be able to provide insightful opinions about what is the best way to introduce the scheme.

Also, the national agreement should recognize that there may appear specific conditions at local level. Therefore, it must allow certain degree of flexibility, which the local authorities will be able to further define through the commitment at a local level.

- **Commitments at a local level:**

- **Local agreement with the energy suppliers:** Once the general framework is established in the national agreement, the local authorities have to adapt and define the final operative details to ensure that the national programme is implemented.

First, the local authorities should identify all the energy suppliers that operate in the area. This may be easy for municipalities that charge a special tax to the energy providers. Alternatively, it is possible that the local energy suppliers would spontaneously express their interest in joining the programme.

The negotiations should be based on the flexibility points left by the national agreement, respecting also the national programme.

- **Non-financial support:** An important issue to be solved is the specification of the non-financial support that the local authority will provide. The national plan and the national agreement should both establish a minimum threshold that the local public bodies have to meet, but the specific set of actions and timing should be based on local conditions. The communication campaign that the local authorities have to perform should have a special consideration. Another essential matter is the creation of a special division in charge of deploying the grants, developing the non-financial support, and answering any non-technical doubts that citizens may have.

Additionally, in the general model the local authorities are the ones that have to verify and control the energy performance certificates, that work as a mechanism to prove the achievement of energy savings.

In the adaptation of the model for the vulnerable households, the local authority plays a key role in providing the grants. There should be clear and specific mechanism introduced, so the energy suppliers know at any time how they may receive a pre-approval grant, or what is the estimated time of receiving the grant.

Additionally, the local authority needs to define a plan to disburse the allocated funds.

The final goal of the agreement is to show to the local operating energy suppliers and consumers the municipality's support for the programme. Consumers' trust and interest from local energy suppliers is essential for the model to work properly.

7.2.3 Mixed energy supplier + municipality model for the FTG package:

- Definition:**

Energy efficiency measures with high investment that significantly improve the energy performance of the dwelling through in-depth renovation. This package of measures is for the entire population. The financial instrument financing this package is intended to cover 20% of the total investment.

- Characteristics:**

- Estimated investment: depend on the country and type of dwelling (SFH or MUB)

Type of dwelling	Estimated investment (EUR)			
	Germany	Italy	Poland	Spain
SFH	50,526	34,527	27,932	34,084
MUB	201,001	105,617	222,635	173,475

- Eligibility criteria:

- List of eligible measures:

List of measures
Lighting
Building envelope
Roof envelope
Replacement of windows
Heat pumps
Photovoltaic

- Process:**

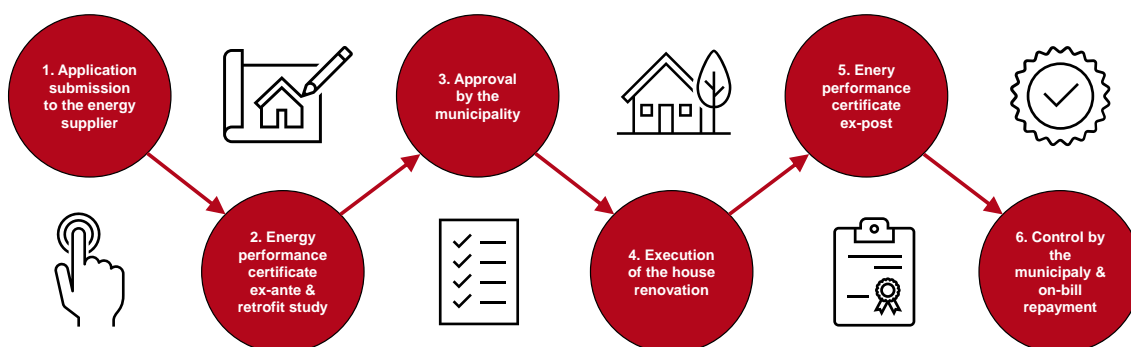


Figure 14. – Step-by-step diagram of the FTG model process

- Application:** Consumers, who have already been informed through the communication campaigns launched by municipalities, will submit their application to their energy suppliers. The application will include the measures to be implemented

and financed through the on-bill scheme. The energy efficiency (EE) measures must be the same as included in the National Plan.

- 2. Energy Performance Certificate ex-ante and retrofit study:** the energy supplier will get an Energy Performance Certificate the dwelling before implementing the EE measures. The measures requested through the application must be consistent with those recommended in the Energy Performance Certificate.

As this scheme is for in-depth renovations, a retrofit study (also consistent with the Energy Performance Certificate) is necessary.

The energy supplier will submit the application form, together with the ex-ante certificate and the retrofit study to the municipality.

- 3. Approval by the municipality:** the municipality will analyse the application form, the Energy Performance Certificate and the retrofit study and will check that the EE measures included in the three documents are aligned. In accordance with the local regulation, the municipality will approve the execution.

If grants apply to this case, the municipality will release a part of the grant with the objective of reducing the up-front costs and thus the risks associated with the operation, which will result in lower financial costs.

- 4. Execution renovation:** implementation of the measures either directly by the energy supplier or indirectly through an energy service company (ESCO).
- 5. Ex-post Energy Performance Certificate:** after the implementation of the measures, another Energy Performance Certificate will be made. The energy supplier will submit the Energy Performance Certificate ex-post to the municipality.
- 6. Control by the municipality & on-bill repayment:** the municipality will compare the ex-ante and ex-post Energy Performance Certificates. If there has been an improvement of the energy performance the remaining grant will be released. If the energy performance has not improved, then the energy supplier will be forced to give the grant back to the municipality.

The consumer will keep paying the investment back through their energy bill, partially or totally offset through the savings.

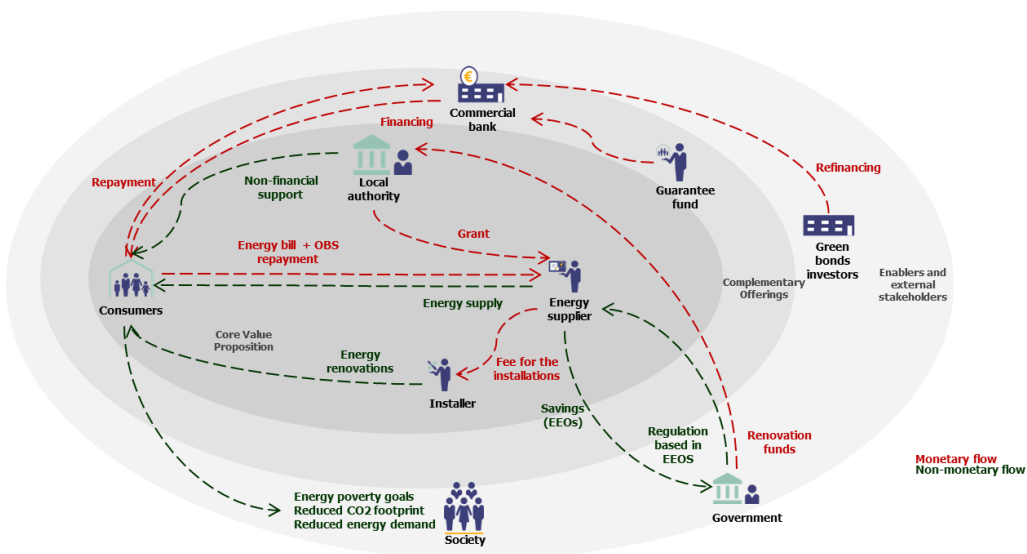


Figure 15. – Mixed model for FTG package

Pros	Energy supplier	<ul style="list-style-type: none"> • Low-risk investment (access to a guarantee fund) • Additional income coming from a new business • Access to a market of (green) bonds • Know-how on retrofitting • Increased consumer loyalty • Good perception in the eyes of society (CSR)
	Municipality	<ul style="list-style-type: none"> • Reduction of emissions • Improvement in the quality of life of citizens • Improvement of the city's aesthetics • Good perception in the eyes of the citizens
	Consumer	<ul style="list-style-type: none"> • Reduction in energy bills • Comfort improvement • Increase of the value of housing • Reduction of the upfront costs
Cons	Energy supplier	<ul style="list-style-type: none"> • Reduction of the energy consumption of their consumers • A new no-core business line • Costs (new staff, technological adaptation of its web platform, etc.) • High payback
	Municipality	<ul style="list-style-type: none"> • Increased workload
	Consumer	<ul style="list-style-type: none"> • Still up-front investment (high part not covered by the instrument) • Do not choose the ESCO • Long-term debt • Higher complexity when moving out
Risk		<ul style="list-style-type: none"> • It needs a relevant volume of applications for economies of scale to apply

Figure 16. – Pros, cons and risks associated with the model

7.2.1 Mixed energy supplier + municipality model for the LHF package:

The LHF package will make more intense use of the grant's component as amounts are much lower and beneficiaries do not have enough financial resources to pay for the measures. In addition, the Guarantee Fund becomes mandatory to overcome the barrier of low credit scoring. The rest of the model works as the once described in the general model.

- **Definition:**

Energy efficiency measures with low investment that significantly increase the comfort of the dwelling.

- **Characteristics**

- Investment: Up to €1,500
- Eligibility criteria:
 1. Personal circumstances (risk of exclusion, energy poverty, vulnerable consumers...).
 2. Any other criterion added by the municipality.
 3. List of eligible measures:

List of LHF Measures
Lighting
Replacement of a broken window or an element (i.e., a glass)
Installation of thermal curtains
Replacement of inefficient old heating devices
Installation of a door between two rooms
Insulation of a space
Installation of a weatherstrips in doors and/or windows
Installation of solar screens for windows

- **Process:**

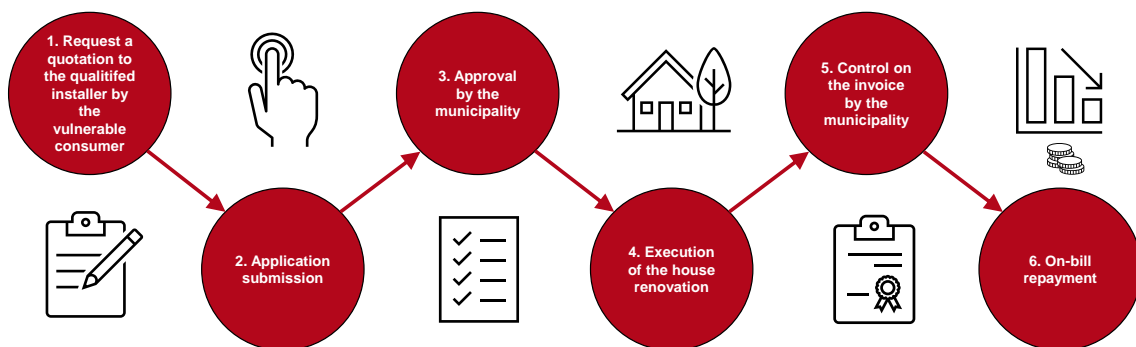


Figure 17. – Step-by-step diagram of the LHF model process

1. **Request quotation to the qualified installer by the vulnerable consumer:** Consumers who have already been informed through communication campaigns launched by municipalities, will check with their energy supplier the list of qualified installers that operate in their area. The consumer will request a quotation to implement measures included in the LHF list.
2. **Application submission:** the consumer submits the application together with the quotation to the energy supplier, who will forward it to the municipality.
3. **Approval by the municipality:** the municipality will confirm that the application form complies with the access criteria. If it does, then it notifies the energy supplier about the pre-approval of the operation.
4. **Execution of the LHF measures:** Once the operation has been pre-approved, the energy supplier contacts the installer to implement the measures. The contractual service relationship will be between the energy supplier and the installer. Therefore, the installer will send the invoice to the energy supplier. The invoice shall specify which measures have been implemented.
5. **Control on the invoice by the municipality:** the energy supplier will forward the invoice to the municipality, which will check that the measures implemented are the same as those included in the application form. After that, the municipality will release the grant to the energy supplier. If the energy supplier does not receive the grant within three months of the submission of the invoice, then the Guarantee Fund will be activated.
6. **On-bill repayment:** for one year, consumers will have to pay the financial costs of the operation, which will be very low due to: no risks (existence of a guarantee fund), the small amount of debt, and financing for a maximum of three months, (this is the estimated maximum time for the grant's disbursement).

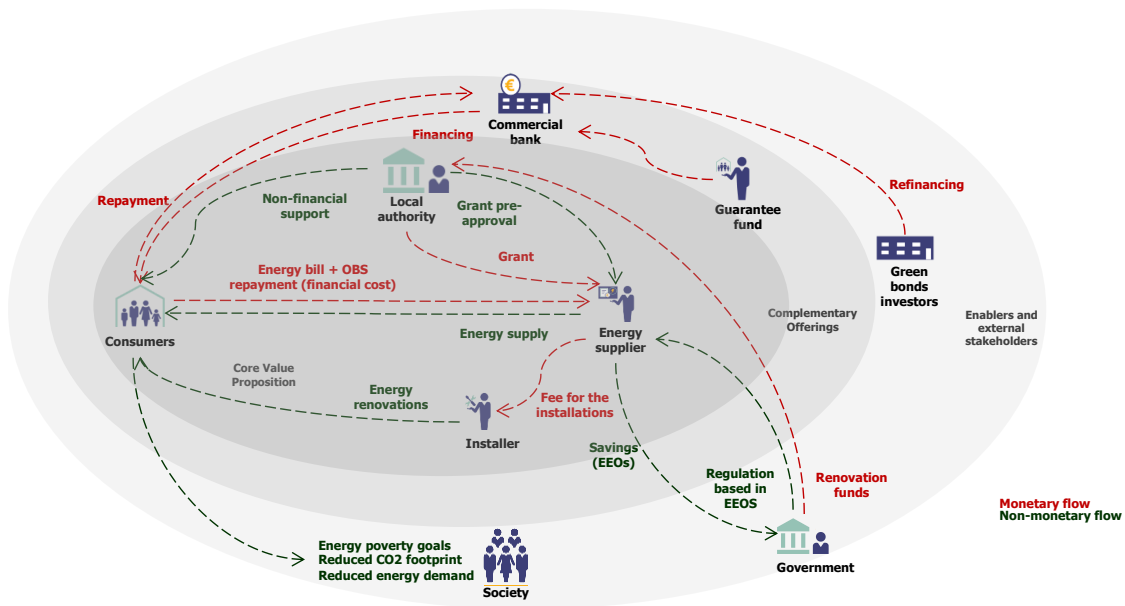


Figure 18. – Mixed model adjusted to LHF

Pros	Energy supplier	<ul style="list-style-type: none"> • Complies with the EEOs • Access to a market of (green) bonds • Increased consumer loyalty and very low risk of insolvency • Good perception in the eyes of society (CSR)
	Municipality	<ul style="list-style-type: none"> • Tackle energy poverty • Reduction of emissions • Improvement in the quality of life of citizens • Good perception in the eyes of the citizens
	Consumer	<ul style="list-style-type: none"> • Comfort improvement • No upfront costs • Reduction of the energy bill • Increase of the value of housing
Cons	Energy supplier	<ul style="list-style-type: none"> • No profit • Costs (new staff, technological adaptation of its web platform, etc.) • Establish a network of installers in the area where they operate
	Municipality	<ul style="list-style-type: none"> • Increased workload
	Consumer	<ul style="list-style-type: none"> • Financial costs added in the energy bill
Risk		<ul style="list-style-type: none"> • It needs a relevant volume of applications for economies of scale to apply

Figure 19. – Pros, cons and risks associated with the LHF model

7.3 Model variation: energy supplier + municipality + DSO as facilitator

One of the main issues in the introduction of the proposed scheme arises when the consumer switches to another energy supplier or when there is a change in ownership (i.e.: the home is sold). Adding the DSOs as facilitators in the model solves this issue, as they are linked to the electricity system (including electricity meter) rather than the consumer. Therefore, the DSO will remain the same during the project lifetime even if the energy supplier changes.

The core of the model remains the same. The energy suppliers are the ones that bear the up-front investment costs, and the ones entitled to receive the on-bill repayment. However, this repayment is now articulated through the DSO.

On top of the electricity costs, consumers have to pay DSO charges in their electricity bill. Under this model, the on-bill repayment is linked to those DSO charges. Once the energy supplier receives the payment, they transfer to the DSO the DSO charges and the on-bill repayment. After receiving it, the DSO transfer the on-bill repayment to the energy supplier that is entitled to collecting them.

DSOs are already highly regulated bodies, with their obligations and charges defined by the public agencies. The DSO has no influence whatsoever in the development or operating of the model and only acts as a facilitator that ensures that the on-bill repayment is collected by the energy supplier entitled to it.

Pros	<ul style="list-style-type: none"> • The consumer has no barriers towards switching the energy supplier • As a regulated body, it is easier to control the DSOs, and through them, the performance of the program • There are already created communication channels between DSOs and Energy Suppliers, which may simplify the solution of conflicts
Cons	<ul style="list-style-type: none"> • Requires an additional agreement with the DSOs • The DSOs are highly concentrated and have high political power, which may complicate the negotiations • The resulting model is more complex, but the energy suppliers still have to bear all the risk
Risk	<ul style="list-style-type: none"> • The DSOs may work inefficiently, which could cause delays in the reception of the on-bill repayment by the energy supplier • DSOs may challenge the enforcement of non-grid-related EEOs on them

Figure 20. – Pros, cons and risks associated with the DSO model

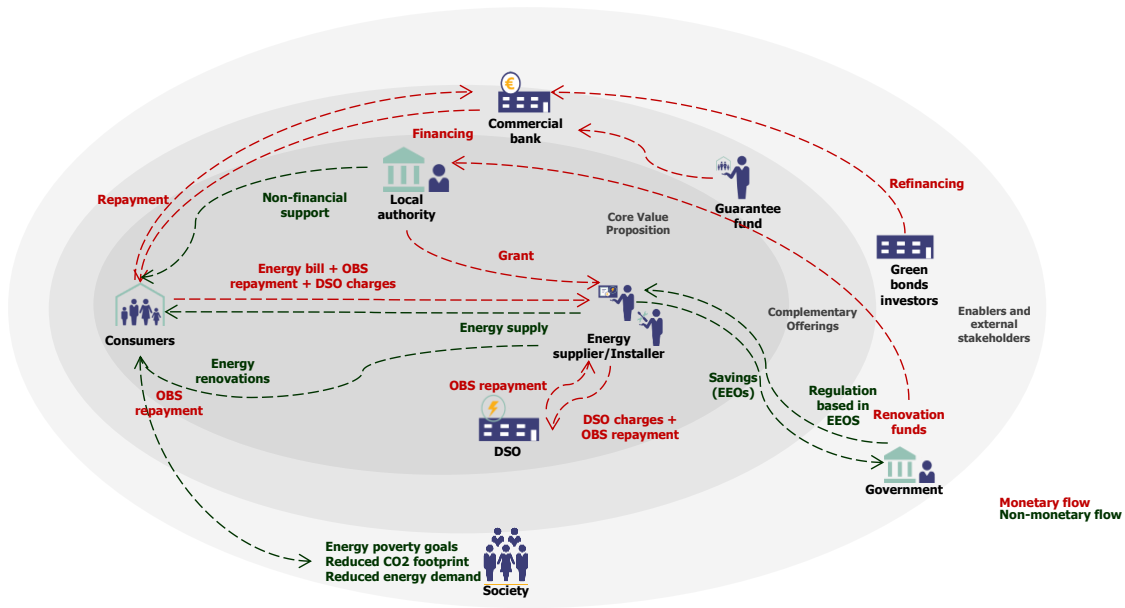


Table 13. – Mixed model with DSO as facilitator

8. Policy recommendations

8.1 Barriers

It is necessary to consider the external factors that are affecting the current market. These pose a challenge for the implementation and effectiveness of the model and cannot be addressed by the financial scheme itself. The following barriers are under consideration:

- **Consumers**
 - **Insufficient consumer awareness:** The energy renovation rate is low in the European Union, even though each focus country of study has implemented one or several financial schemes. Consumers are not always aware of the existence of the schemes, or the benefits of efficient renovations. Energy poverty is a persistent problem, now exacerbated by the energy crisis that also threatens the middle classes. However, for those on higher incomes the price of energy has not traditionally been high enough to incentivise them to renovate. Some recent measures adopted by governments to limit energy prices have the effect of dampening consumer interest in renovation because lower prices reduce the potential for economic savings.
 - **Low-income consumers are associated with high credit risk:** Despite evidence showing the opposite (at least when it comes to homeowner’s associations), certain traditional financing methods may link low income with high credit risk, undermining the financing options available to them.

- **Energy suppliers**
 - **Lack of interest from energy suppliers:**
 - **Conflict of interests:** The core business of the energy suppliers is the sale of energy. In principle, saving energy on the final user is not beneficial for them. EEOs can bridge this gap, imposing obligations for them. However, experience has showed that often the cost of these obligations is passed on to clients via energy tariffs.
 - **Reduced financial profit:** The imposed low interest rates makes the energy suppliers receive financial return below the expectations that a similar financial product would have in the market. The energy suppliers are private companies driven by the profitability of the investment. Unappealing financial results will result in hesitation to join the programme.
 - **Insufficient financial resources:** According to the model, the energy suppliers have to bear a huge up-front cost. 20% of the investment in the general model, and the whole amount, up to €1500 in the adaptation for LHF. In case of lacking own resources, the energy suppliers would have to access commercial banking adding costs to the whole model.
 - **Energy suppliers may prefer other options to fulfil the EEOs:** One of the bases of the program is incentivise energy suppliers to participate, by using the mechanism of the EEOs. However, the energy suppliers may decide to fulfil that obligation through the less costly available alternatives, discarding energy related retrofits.
- **Public administration:**
 - **Lack of reliable precise information on the building stock and the profile of consumers at European and national levels:** To deploy any national plan it is necessary to define the scale of the actions that are required to be implemented. To do so, the public administration must rely on quality data. However, there is a lack of detailed information available about the residential building stock in Europe.
 - **Local authorities have limited resources:** Many municipalities are already struggling to perform all their responsibilities. The addition of new sources of expenses, as well as the necessity to create special divisions to manage the programme may be a barrier. The inability to perform the non-financial support activities may greatly harm the model, in terms of visibility and consumer's engagement. As mentioned in 8.2.4, municipalities can also leverage in energy agencies, social and environmental associations for certain tasks.

8.2 Policy recommendations

During the development of the financial instrument model, barriers have been identified as described in section 8.1 this report. This section provides a number of recommendations drawn from research on the market, financial instruments, and interviews with national experts. The recommendations are divided into two segments: policy recommendations and market recommendations.

In addition, an analysis for each measure is presented, showing the barriers addressed. The conclusion of this analysis is presented in Figure 21.

POLICY RECOMMENDATIONS	BARRIERS				
	Insufficient consumer awareness	Low-income consumers associated with high credit risk	Lack of interest from energy suppliers	Lack of reliable information	Limited resources of local authorities
National plan to incentivize energy retrofits	✓		✓		✓
Creation of a guarantee fund		✓	✓		
Revision of the EED			✓	✓	
Engagement strategy at local level	✓				
Statistics and reliable precise data	✓			✓	
Grants for vulnerable consumers	✓	✓			
Regulate the concept of “homeowners’ association”		✓	✓		
Development of the framework for GBI			✓		

■ Requirements for the implementation of the financial instrument
■ Recommendations for a smoother implementation

Figure 21. – Policy recommendations per barrier

For each measure, it has also been indicated the expected impact on the market if the measure is implemented. The following legend has been used to represent the expected impact:

- ✓: Low Impact
- ✓✓: Medium impact
- ✓✓✓: High impact

Recommendations	Expected impact
National Plan to incentivise energy retrofits	✓✓✓
Creation of a guarantee fund	✓✓✓
Revision of the EED	✓✓✓
Engagement campaign at local level	✓✓✓
Statistics and reliable precise data	✓✓
Grants for vulnerable consumers	✓✓✓
Regulate the concept of “homeowners’ association”	✓✓✓
Development of the framework for green bonds	✓✓

Table 14. – Expected impact of the policy recommendations

8.2.1 Recommendation 1 – National Plan to incentivise energy retrofits

To introduce the proposed financial scheme, it is necessary to ensure the collaboration between the three key players (public bodies, energy suppliers/DSO and consumers). Clear rules, information about the allocation of funds and a transparent explanation of the model are required to gain the trust of the involved stakeholders. This can be achieved through the design of a National Plan to incentivise energy retrofits, which will define the long-term strategy, implemented through the tactical and operational decisions. National plans must be aligned with the EED and the obligations that the EED imposes. Furthermore, the revised EPDB and the Fit for 55 Package must be considered, since they contain relevant provisions regarding energy building performance (energy performance certificates, minimum standards, digitalisation) and energy poverty (including the Social Climate Fund). National Plans must gain enough visibility and must be consistent with existent and forthcoming regulation. At the same time, national plans must contain flexibility points that allow actions to be tailored to the reality and/or circumstances of each country or region within the country. The national plan has to solve the barriers related to the interests of the players and should allocate sufficient financial resources to the public authorities.

Recommendation	1	National plans to incentivize energy retrofits
Barriers to be addressed		<ul style="list-style-type: none"> • Insufficient consumer awareness • Uninterested energy suppliers • Limited resources of local authorities
Impact	✓✓✓	The objective of this measure is to define a long-term strategy for tactical (medium-term) and operational (short-term) decisions, laying the foundations for the operation of the scheme in each country and adapting it to its context.

8.2.2 Creation of a guarantee fund

Engaging vulnerable consumers is essential for the success of energy renovations. The financial barriers related to them are drawbacks that may threaten the achievement of the energy efficiency goals. The Guarantee Fund would solve the issues created by the bad credit ratings and also would make it more interesting to the energy suppliers to fund EE projects. Additionally, the Guarantee Fund would benefit the non-vulnerable households.

Recommendation	2	Creation of a gurantee fund
Barriers to be addressed		<ul style="list-style-type: none"> • Vulnerable consumers are associated with high credit risk • Uninterested energy suppliers
Impact	✓✓✓	All vulnerable consumers would be directly covered by this guarantee fund in a very short time, while the risk of non-payment by consumers of the FTG package would be reduced.

8.2.3 Revision of the EED

The energy suppliers and DSOs may be reluctant to participate in financial schemes. The energy suppliers have to face a conflict of interest, as the energy renovations would lower the amount of energy sold to their customers. These could be partially compensated by the interest of electric utilities to replace other sources of energy (i.e.: gas), but it may not be enough to undertake deep renovations. On the other hand, DSOs may want to limit their activity to taking care of the energy grid. By using the EED it would be possible to impose concrete obligations on energy suppliers and DSOs, so they would need to participate in the scheme. As the financing scheme has an adaptation to protect vulnerable consumers, the LHF type, this would ensure that all consumers would be considered and given the opportunity to retrofit their dwellings.

Recommendation	3	Revision of the EED
Barriers to be addressed		<ul style="list-style-type: none"> • Uninterested energy suppliers • Uninterested DSOs
Impact	✓✓✓	The aim of the review would be to impose concrete obligations on both the DSO and energy suppliers towards consumers, especially vulnerable consumers.

8.2.4 Engagement campaign at local level

Consumers may not be fully aware of the necessities and benefits of energy retrofits. The non-financial support provided by the public bodies should aim to overcome this knowledge gap. Energy agencies, social and environmental associations can support the local authorities in this matter. Furthermore, the higher the energy efficiency education, the lower the risk of rebound effect.

Recommendation	4	Engagement strategies at local level
Barriers to be addressed		<ul style="list-style-type: none"> • Insufficient consumer awareness
Impact	✓✓✓	Local authorities have direct contact with consumers, so they are necessary to educate citizens on energy efficiency and make them aware of the benefits (economic and comfort) of implementing the measures included in the packages.

8.2.5 Statistics and reliable precise data

The national plan has to define items, where the information available is limited. As the model bases the certification of the energy savings on the Energy Performance Certificates, it would allow the national governments to ensure that the buildings that take part in the programme are assessed. The increase of reliable information will help to allocate the financial resources more efficiently each time, and also, to create better campaigns to reach out to consumers, increasing their awareness.

Recommendation	5	Statistics and reliable precise data
Barriers to be addressed		<ul style="list-style-type: none"> • Insufficient consumer awareness • Lack of reliable information on the building stock and the profile of the consumers at European at national levels
Impact	✓✓	At the time of the study, the consultant team found that official data on the building stock and consumers are very limited. This information is absolutely necessary to be able to diagnose the current scenario and regulate accordingly.

8.2.6 Grants for vulnerable consumers

Low-income consumers have limited access to financial schemes due to their low credit rating. Grants must be in place to lower financial cost and fill the lack of up-front capital. These grants should be designed and disbursed in synergy with other financial instruments, and not implemented as a standalone.

Recommendation	6	Grants for vulnerable consumers
Barriers to be addressed		<ul style="list-style-type: none"> • Insufficient consumer awareness • Vulnerable consumers are associated with high credit risk
Impact	✓✓✓	To secure the participation of the vulnerable consumers, it is necessary to develop a grant program for them. This measure protects the consumer and allows for a much greater number of households to benefit from increased thermal comfort

8.2.7 Recognition of the concept of “homeowners’ association” in European legislation

The homeowners’ associations in Poland are the main factor of energy renovations in the country, due to their ability to concentrate the consumers and borrow money at reduced interest rates due to the reduced risk they represent. Even if some households do not pay their community fee in time, there are other dwellings that cover by far the amount of the repayment. De facto, those associations act as private guarantee funds. They have the possibility to protect further the vulnerable consumers, as only the homeowners’ association manager will know about their socioeconomic issues. Also, as the projects that involve the entirety of a MUB are much bigger than for an individual flat, the energy suppliers would be very much interested in performing them.

Recommendation	7	Regulate the concept of “homeowners’ association”
Barriers to be addressed		<ul style="list-style-type: none"> • Vulnerable consumers are associated with high credit risk • Uninterested energy supplier
Impact	✓✓✓	It is necessary to legislate this figure at European level in order to homogenise the criteria, providing it with legal personality and the capacity to take on debt.

8.2.8 Development of the framework for green bonds⁵⁸

The energy suppliers are private companies that require profitability in their operations. The limited financial benefits that the proposed model offers can be overcome by issuing associated financial assets and liabilities. The development of a framework for green bonds would allow the energy suppliers to access new sources of debt and to possess a tradeable debt document. Energy suppliers will be able to commit to performing energy retrofits in both type of the model, the FTG and the LFH, reaching all consumers in the market.

Recommendation	8	Development of the framework for green bonds
Barriers to be addressed		<ul style="list-style-type: none"> • Transaction costs and complexity of the model • Uninterested energy supplier
Impact	✓✓	Green bonds can add liquidity to the refinancing market for energy suppliers, as they are tradeable securities.

⁵⁸ On February 28th, 2023 (after the research stage for the study concluded), a provisional agreement on EU green bonds was reached. Further information can be found in [here](#).

9. Annexes

9.1 Additional statistical data about the current residential market

The residential building market is very complex and there is limited information available. To give more insight into it, the following graphs show the evolution of the variation of the tenure status and type of dwelling. The analysis considers the country of study against the European Union average value.

9.1.1 Germany

Figure 22 shows the evolution of the distribution of households by tenure status. It can be observed that there is a sustained increase in tenants, that is even steeper after 2020. This may be caused by the increased mortgage fees and the reduction of available houses for sale in 2021, in relation with the increase in base interest points of the European Bank. There are additional housing policies measures that affect the popularity of renting over house ownership, as relatively high real-estate transfer tax, and the absence of mortgage interest payments tax deductibility for owner occupiers⁵⁹. Housing policies that incentivise house rentals have been reinforced during the pandemic.

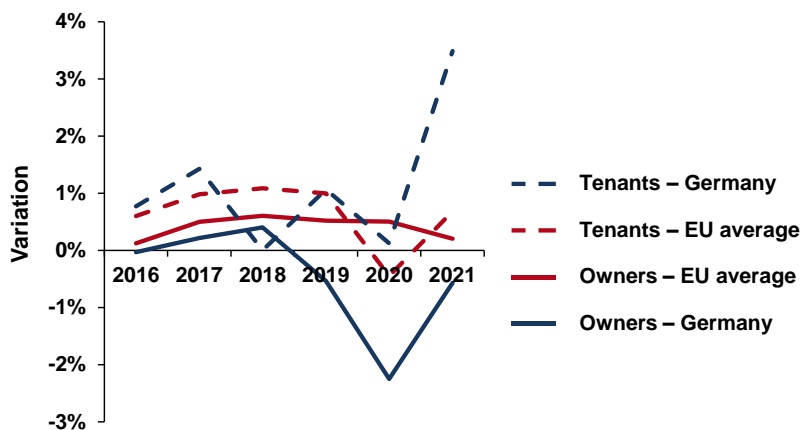


Figure 22. – Variation of households by tenure status in Germany and EU average⁶⁰

Figure 23 presents the evolution of the variation in distribution of households by the type of dwelling. There is a trend of households transferring towards SFH from MUB, that was only stopped during 2020. However, the MUBs maintain their influence, as for 2021, over 56% of the households live in MUB buildings. It may be assumed that as the income level of the households keeps increasing, the SFH are more attractive for people than the MUB. It is remarkable that both SFH and MUB present a negative variation in 2020. This is due to the fact that Eurostat considers another category called “Others”⁶¹, that due to its relatively low significance - 3% in 2021 - is not contemplated in the graph.

⁵⁹ Bundesbank (2020), [Reasons for the low homeownership rate in Germany](#)

⁶⁰ Eurostat (2022), [Distribution of population by tenure status](#).

⁶¹ Eurostat does not provide a clear specification of what this concept covers; this additional category includes all dwellings that are not any kind of SFH buildings or flats inside MUB.

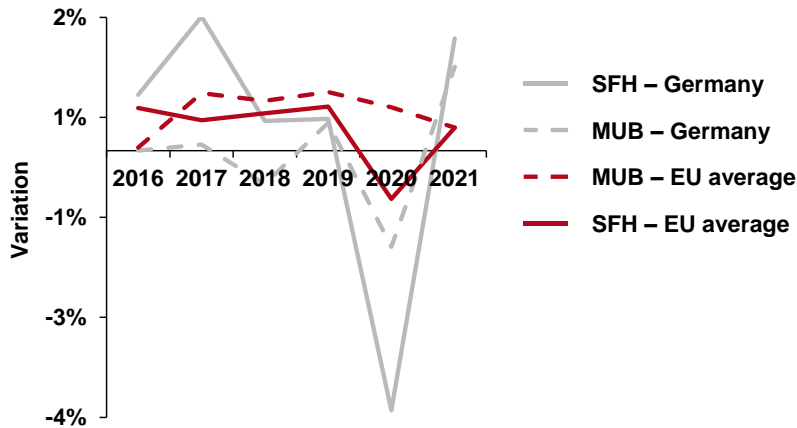


Figure 23. – Variation of households by type of dwelling in Germany and EU average⁶²

9.1.2 Italy

Figure 24 shows the evolution of the variation in the distribution of households by tenure status. There was little to no variation between 2017 and 2019. However, the situation changes in 2020, when there was an increase in house-owners. This shifted again in 2021, when there was an increase in tenants. The increase in ownership could have been produced by the decrease of houses and flats available for rent, as during the COVID-19 pandemic many landlords decided to sell their properties, which provoked a decrease in sales prices in 2020⁶³. This reduced the supply of flats available for rent. This situation was reverted in 2021, when many investors entered the Italian market as they were seeing a potential market increase. The pandemic was followed by a tightening of credit conditions, inflation hikes and the increase of monetary interest rates, which increased the financial costs associated to mortgages. The sum of these factors made the renting market become a preferred option. This is evidenced in the fact that overall, rents in 2021 maintained the levels of 2020⁶⁴. The increase in supply allowed it. The shift in tenure has been also affected by the housing prices index for Italy, which was still below 2015 prices in 2020, while it started increasing in 2021. This could motivate the spike in 2020 for house-owners⁶⁵.

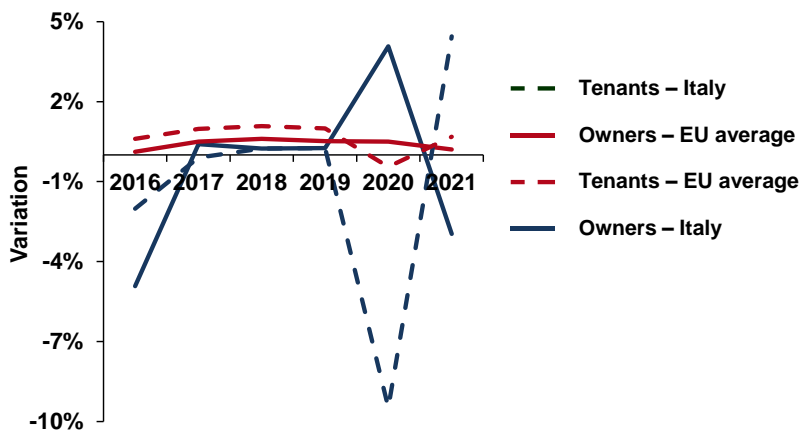


Figure 24. – Variation of households by tenure status in Italy and EU average⁶⁶

⁶² Eurostat (2022), [Distribution of population by type of household](#).

⁶³ The Bank of Italy (2022), [Italian Housing Market Survey](#).

⁶⁴ Eurostat (2022), [Evolution of house prices and rents](#).

⁶⁵ Eurostat (2022), [House Price index](#).

⁶⁶ Eurostat (2022), [Distribution of population by tenure status](#).

Since 2017 the number of households living in MUB has been increasing. This increase has been intensified in 2020. This behaviour coincides with the average EU variation. One of the reasons may be the effect of COVID-19 on rural areas, where there is a higher influence of households living in SFH. As the number of households living those areas is reduced, the influence of urban MUB increases. It is remarkable that both SFH and MUB presented a negative variation in 2020. This is due to the fact that there Eurostat considers another category called “Others”, that due to its relatively low significance - 1% in 2021 - is not contemplated in the graph.

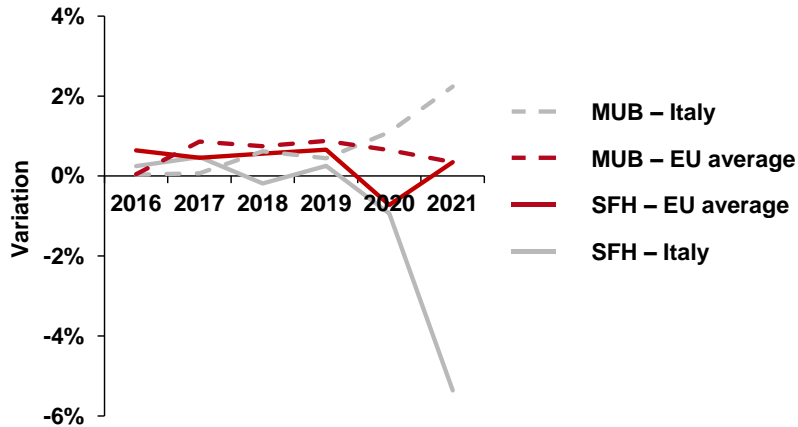


Figure 25. – Variation of households by type of dwelling in Italy and EU average⁶⁷

9.1.3 Spain

The importance of renting demonstrated a clear increase between 2016 and 2020, with the trend dropping after 2020. The behaviour was similar to the EU average until 2020. The increase in home-owners in 2021 is explained by the faster increase in rentals for housing than house prices. Comparing 2010 and 2021 data, Spanish rent prices went up by 5%, while house prices decreased by 5%⁶⁸. Paired with low mortgages costs, purchasing a home become more beneficial for households than renting.

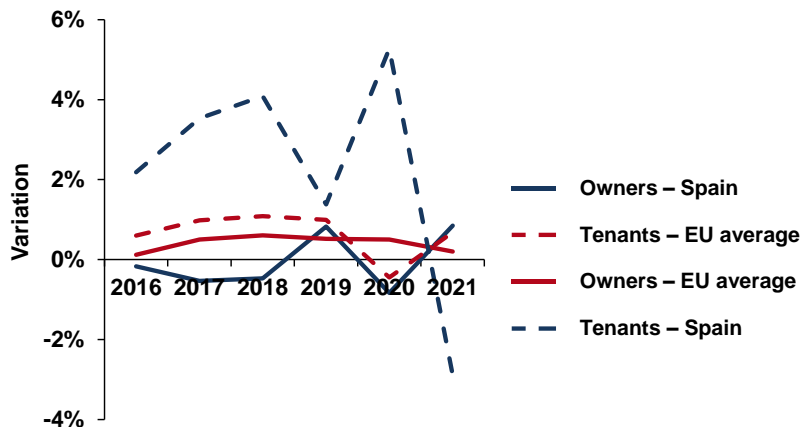


Figure 26. – Variation of households by tenure status in Spain and EU average⁶⁹

⁶⁷ Eurostat (2022), [Distribution of population by type of household](#).

⁶⁸ Eurostat (2021), [Report on rents and house price](#).

⁶⁹ Eurostat (2022), [Distribution of population by tenure status](#).

Regarding the type of dwelling between 2017 and 2019 there was a trend to change MUBs for SFH, but from that year onwards the MUBs recovered their growth. Additionally, since 2019, the trend of the variation in Spain is very similar to the EU average. Approximately 66% of households reside in MUBs. A reason that would explain this is the COVID-19 quarantine restrictions. In 2020, many households that lived in one of the big cities, decided to leave their primary dwellings and spend the pandemic in the flats they owned in other, smaller, cities. Another group of the population having an impact are low resource households, that had no option but to join the flats of their relatives, increasing the influence of MUBs. However, after the pandemic the trend is returning to its 2019 levels.

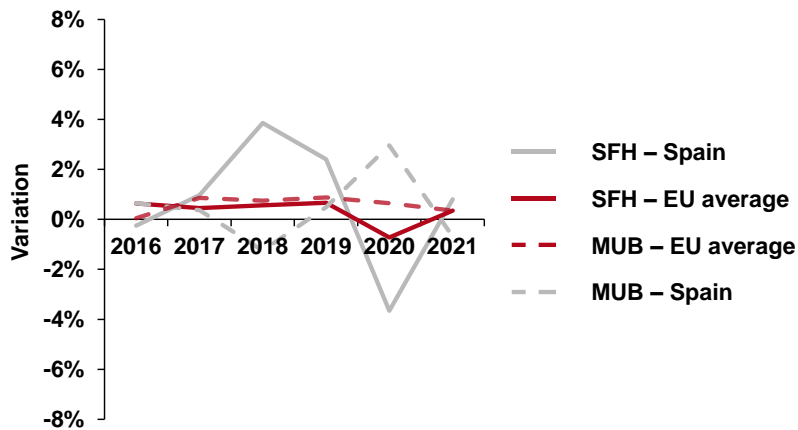
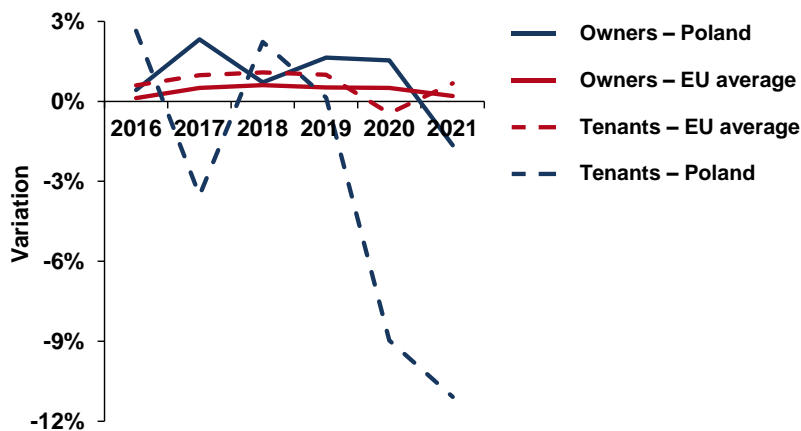


Figure 27. – Variation of households by type of dwelling in Spain and EU average⁷⁰

9.1.4 Poland

In contrast to the EU average variation, between 2016 and 2020, there has been an increasing trend in the value of homeowners, while the tenants are declining. This behaviour was even greater for 2020. In 2021, less than 13% of households were considered tenants. The negative variation of both owners and tenants is explained by the negative variation, of 3%, in the overall number of households in Poland. The main effect is higher mortality rates, that were not compensated by the positive migratory flows that the country had in 2021. In Poland there were higher rates of excess mortality in 2021 than in 2020⁷¹.



⁷⁰ Eurostat (2022), [Distribution of population by type of household](#).

⁷¹ Eurostat (2022), [Excess mortality](#).

Figure 28. – Variation of households by tenure status in Poland and EU average⁷²

Regarding the type of dwelling between 2017 and 2019 there was a clear increase in MUBs, but from that year onwards MUBs started to decline. Approximately 55% of households reside in SFHs. The reduction in both categories may be explained by the overall reduction in the number of households, that has been explored in the explanation of the first category.

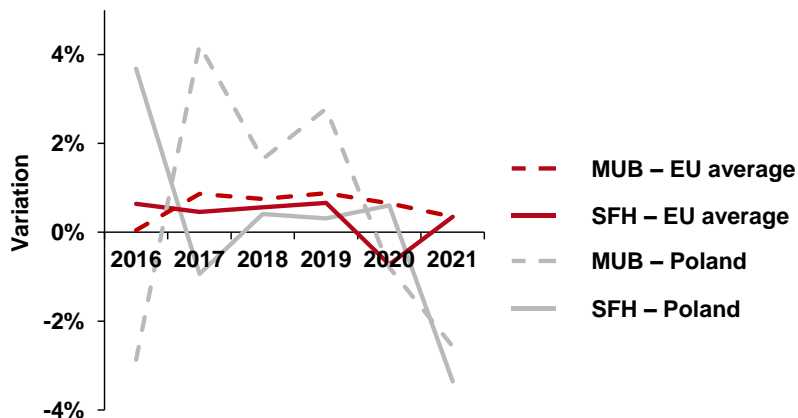


Figure 29. – Variation of households by type of dwelling in Poland and EU average⁷³

⁷² Eurostat (2022), [Distribution of population by tenure status](#).

⁷³ Eurostat (2022), [Distribution of population by type of household](#).

9.2 Summary of the performed interviews

9.2.1 EU – Level

Interviewee position /Institution	Confidential
Sector	Financing
Insights related to:	
Green Bonds Issuance	<ul style="list-style-type: none"> • To become an issuer, the private or public entity must have a rating provided by Moodys or Standard and Poor's. Normally, only very big entities will issue bonds, municipalities with a good rating can issue bonds. • Banks are interested in green bonds because they need to comply with their ESG policies. But the minimum amount is normally €500m. • At some point some advantages regarding the interest rate (better deals) could be observed, but not at this moment. The only advantage that GBI could represent is because the volume of investors is a bit higher, which increases the opportunities to sell.
Guarantee Funds	<ul style="list-style-type: none"> • Regarding guarantee funds, certain institutions (i.e. EIB) invest in risky portfolios, offering 3-7% of interest.

9.2.2 Germany

Interviewee position /Institution	Team Leader, Planning and consulting DENA (German Energy Agency)
Sector	Public sector
Insights related to:	
Mixed model Supplier + Municipality	<ul style="list-style-type: none"> • In principle, the model is interesting. • Customer's segmentation needs to be carefully thought in Germany because majority are tenants. • Interestingly, the ownership trend is growing. Government support for affordable rents has been reduced over the past few years, driving families to purchase dwellings. On top of that, other factors may impact this trend: interest rate changes, inflation, crisis etc.

Interviewee position /Institution	Senior expert on energy efficiency financing Confidential source
Sector	Confidential
Insights related to:	
Mixed model Supplier + Municipality	<ul style="list-style-type: none"> • It would be difficult to implement, as the energy suppliers are not very innovative. • The tenant's dilemma is huge, over 50% of households rents their dwellings. • Models that reduce or eliminate the financial risks and technical complexity for private owners are suitable for a better take-up by private owners. • In the development of attractive offers for private owners, third actors, e.g., energy supply companies, can play an important role using state subsidies.
Main barriers for implementing energy efficiency measures	<ul style="list-style-type: none"> • Financing is not the main problem in Germany. It is the lack of clear market signals to save energy, which translates into low customer awareness. When the awareness is increased, like during the energy crisis and price hikes, everyone wants to renovate. • New models to overcome barriers with private owners (homeowners, condominium associations, small landlords) are needed to advance energy policy goals.
Currently enforced measures to incentivize energy efficiency	<ul style="list-style-type: none"> • Germany has a CO2 tax for landlords. This creates a stimulus for renovations.

9.2.1 Italy

Interviewee position /Institution	Senior Investment manager Aquila
Sector	Financing
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> • Ecobonus can be a good instrument to boost renovation provided that two issues are fixed: 1) the upward impact on prices of the support 2) the lack of incentives since the grant provided by the Ecobonus was too high.
Mixed model Supplier+ Municipality	<ul style="list-style-type: none"> • The model present difficulties: too complex (too many stakeholders and energy suppliers at the centre (they are not interested in renovation)).
Interviewee position /Institution	Head of international projects Federesco

Sector	ESCO association
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> • The renovation scene in Italy has been totally dominated by Ecobonus in recent years. • The main criticism of Ecobonus is the lack of real tradability of the credits; banks, acting monopolistically have not guaranteed liquidity, generating serious uncertainty in the scheme. • Other issues emerged related to high transactional and financial costs and excessive bureaucracy. • On the other hand, the problem of the price increase proportional to the volume of support can be easily solved if a long-term strategy is implemented.
Mixed model Supplier+ Municipality	<ul style="list-style-type: none"> • Antitrust regulation in Italy may pose a barrier for energy suppliers entering the renovation market.

9.2.1 Spain

Interviewee position /Institution	Founding Partner Greenward Partners https://greenwardpartners.com/es/
Sector	Investors and facilitators of energy renovations
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> • In Spain, non-market-based mechanism (grants) have undermined the chances of developing innovative financing. Grants and subsidies distort the market, making it difficult for market-based solutions to succeed. Consequently, when the grants are over, mechanisms to keep up with the renovation have not been created and the process gets stuck.
Role of innovative financing	<ul style="list-style-type: none"> • Financing mechanisms must include the energy asset as part of the scheme, backing up the investment, regardless of who owns the house.
On tax or on bill	<ul style="list-style-type: none"> • PACE has more potential than on-bill schemes, being the energy asset included in the notary deed. • Energy suppliers will not be easily motivated towards deep renovations. In the best case scenario, they will launch programmes to change boilers. Their interest is electrification.

Interviewee position /Institution	Deputy assistant general manager MITECO (Ministry of Ecologic transition) https://www.miteco.gob.es/es/
Sector	Public sector
Insights related to:	
Energy renovation in residential in your country: the CAEs system	<ul style="list-style-type: none"> • In principle, CAES (Spanish mechanism to comply with the EED) could be compatible with supplier-centred models; deep renovations are in the CAE's list of interventions and suppliers are obligated parties. • In this case, the supplier, acting as an obligated party must sign a private agreement with the investor (normally the homeowner). The agreement will specify the amount of savings that the obligated party (in this case, the supplier) intends to achieve and the payment in return. This agreement must be signed before renovations measures are deployed, but the certificate is only issued at the end. Once the savings are achieved, the obligation towards administration can be either cancelled or traded. Up-front financing is something that the investor and the obligated party must sort out, accessing, if the criteria is met, to public support. In this regard, CAEs are compatible with MITMA support scheme for residential (grants combined with soft loans). On the other hand, there is a clear incentive for banks willing to access to GBI, because the investment made in CAESs measures is automatically considered green (to potentially access GBI).
Municipality centred	<ul style="list-style-type: none"> • MITECO were supportive of PACE, and they tried hard to introduce it, but the regulatory changes needed failed to be implemented. • In Spain, the so-called "green offices" already provide non-financial support to energy renovation.
EEOs	<ul style="list-style-type: none"> • Suppliers will only be encouraged to deep renovations in cold areas of the country, were savings and therefore, economic returns can be achieved. • In the rest only small renovations make economic sense. • Only when the kW/h saved per year through renovations is cheaper to deliver than contributing to the Energy Efficiency Fund, renovations will take place. The National Fund for Energy Efficiency is currently devoted to finance government programmes in energy efficiency.

Interviewee position /Institution	AÚNA Coordinator Green Building Council Spain https://www.aunaforum.com/en/home-en/
Sector	Construction/financing and renovation
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> The support scheme launched by the government has helped to start the renovation process in Spain, but it is clearly not enough to cope with the need for deep and massive renovation. One positive aspect is that for the first time, banks are providing credit for these projects, thanks to the support from the public guarantees (provided by ICO – public financial institution)
Role of innovative financing	<ul style="list-style-type: none"> In the future, these type of financing schemes will be certainly needed. At present however, with the market flooded with grants and credit from commercial banks, there is no sense of urgency to seek innovation in financing. From Foro Auna⁷⁴, the focus now is being made in the revalorisation and monetisation of the investment. Additional financial schemes such as green reverse mortgages are becoming increasingly attractive to the market.
On tax or on bill	<ul style="list-style-type: none"> In principle, on tax instruments seem more appealing because energy suppliers are not easily engaged in deep renovations. When energy suppliers enter the renovation arena, it is normally limited to small and isolated measures.
EEOs	<ul style="list-style-type: none"> Theoretically, EEOs could help to boost renovations. In practice, however, the obligated parties will only tackle those projects that are profitable for them, which excludes deep, massive renovations. Specifically, energy suppliers will focus on boiler replacements and electrification measures.
Guarantee fund	<ul style="list-style-type: none"> According to the conclusions extracted from AUNA final report, which collected the views from different stakeholders, a guarantee fund is mandatory to succeed in the renovation process.

⁷⁴ Foro Aúna is a national forum of Spanish stakeholders for dialogue between actors from the financial, rehabilitation and energy sectors, as well as the public administration and citizens, on energy retrofit focusing on residential. <https://www.aunaforum.com/>

9.2.2 Poland

Interviewee position /Institution	Vice-president of the management board NAPE (National energy conservation agency) https://nape.pl/
Sector	Energy efficiency consultancy
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> • Currently, Poland uses a soft-loan and grant model. • In Poland thermo-modernisation is a key factor. The district heating companies can obtain a white certificate, issued by the Polish government, that is a tradeable asset. In practice, it is similar to a grant, where the benefits are shared between the energy supplier and the house owner.
ESCO	<ul style="list-style-type: none"> • Overall, the ESCO market is not very developed in Poland. Energy prices until very recent were not high enough to stimulate ESCO markets (now it is changing). There have been two or three ESCOs for more than a decade but they do not undertake big projects. • There is a special governmental programme, “ESCO +”. It is a pilot programme, supported with EU funds, that englobes nine thermal modernisation projects. The first step was to perform energy audits, in order to define the optimal improvements to implement. In the current phase, the government wants to attract ESCOs in order to finance and perform the renovation.
On tax or on bill	<ul style="list-style-type: none"> • The on-bill model has been used for small renovations in kitchen appliances, but there were little to no energy savings. It would be difficult to implement for other purposes, as the energy suppliers are completely implemented and are guided by profitability principles. It is improbable that larger projects would be profitable for energy suppliers. • There is lack of knowledge and willingness from the local authorities to lead an on-tax solution.
Financial risk management	<ul style="list-style-type: none"> • The most common practice in Poland is the renovation of MUBs. In Poland, all the MUBs in a certain area are concentrated into a single community that is administered by a facility manager. • These communities function as an organisation and can be financially responsible. Due to the large amount of households that belong to each community, commercial banks do not ask for any additional guarantees. • A common good practice of the MUB communities is to reserve 70% of their income, that is essentially the

	<p>monthly payments made by households, to repay and debt they may have. This helps to reduce the perceived risk by the commercial banks and allows even low-income households to access funds that otherwise would have been out of the reach.</p>
Potential barriers	<ul style="list-style-type: none"> • The MUB communities are the main target for energy related renovations. The decision of the scope of the renovation is concentrated in the manager of the community. Usually, those managers lack the necessary skillset and knowledge to perform a deeper retrofit, or to employ innovative technologies. They lack the ability to coordinate several projects at the same time. In this situation, the ESCOs companies could be the right solution. However, they are also the most expensive solution on the market.

Interviewee position /Institution	<p>Innovative financing of energy efficiency projects expert KAPE (Central energy conservation agency) https://kape.gov.pl/</p>
Sector	Public agency
Insights related to:	
Energy renovation in residential in your country	<ul style="list-style-type: none"> • The current model was established in 1998 and works well for the current needs of the system. It is based on a loan and grant model. Recently, the grant has been increased from 20% to 26%. There is also a special programme for areas with high air pollution, where they offer up to 70% grants for the renovation of the heating systems.
ESCOs	<ul style="list-style-type: none"> • The government realises that there is a need for several financing institutions that would support the project through its different stages. • It is difficult for the ESCO companies to finance projects now. They need to modernise. • The subsidy (soft loan + grant) offered by the national programme is granted to the homeowner. They tried granting it to the ESCO directly, but banks do not trust them. Energy saving guarantees are seen as a risk rather than a benefit/profit from the ESCO. The banks fear the subsidy could be cancelled if savings are not reached.
On tax or on bill	<ul style="list-style-type: none"> • The on-bill model has been only implemented for the change of small appliances. The on-tax model is not applied. There is no interest from the energy suppliers to get repaid on an on-bill basis.

<p>Innovative financing model</p>	<ul style="list-style-type: none"> • Difficult to implement in Poland. The current system in Poland is quite good and clear. The national fund for environmental protection uses EU and domestic money. There are organized models that define each of the modernisation types. It is easier the current way, than involving too many actors (governments, ESCO, banks, green bonds etc.). The thermo-modernisation program has the state bank involved in it.
<p>Potential barriers</p>	<ul style="list-style-type: none"> • The current model is clear, transparent, and simple. It could be better if the guaranteed savings would be greater, but in case of residential buildings it is difficult to increase the energy efficiency if there is no change in consumer behaviour. If behaviour change towards energy consumptions is not supported, it can impede the expected energy savings; i.e, households will not save as much energy as planned. • ESCO/EPC model is based on energy control. You cannot have any energy control in the private dwellings. Small ESCO companies rely on the surplus savings. 15 years of energy management allows them to stabilise the financial flows. The lack of control on energy used/produced, then they bear unlimited risk. It is difficult to develop the ESCO market based on the private residential sector. That is why Poland wants to develop them through public procurement offers.

9.3 Analysis of selected financial instruments

9.3.1 General model or “filling the gap” package

- **The Core Value proposition or how this model works**

On one side there are the consumers, who are in need of energy retrofits. However, they lack the financial resources, knowledge, or other kinds of support. On the other side, there are the public authorities, which have a special interest in the energy retrofits in the residential market, as it necessary to achieve the decarbonisation goals. They can easily cover the non-financial support; but they are not able to continuously offer up-front financial investments. In order to set a bridge between the agents, it is necessary to introduce the energy suppliers/DSO that would help to solve the barriers each agent has, while achieving the overall objectives.

To determine the collaboration scheme between the parties, the national government should sign a framework agreement with the energy suppliers/DSO. This contract would establish the basic relationship, roles and responsibilities. Once it is ready, the local governments would be able to join the programme and offer their citizens the benefits that it brings. As the situation of each municipality is different, the local public authority will have to define any possible additional requirements or measures, as well as confirm the willingness of the local energy suppliers to participate. There is a possibility that the energy suppliers that operate in the area are the ones to have the initiative to join the program. However, it is essential that they reach an agreement on any possible special term with the local authority. Once the bases are defined, the national government will be able to transfer special funds that would allow the model to work properly..There are some key roles and responsibilities that should be taken into consideration:

- Municipality – The most interested agent in lowering the energy consumption of building and increasing the energy welfare of their citizens. It offers incentives to other agents to act. Those incentives are based both on financial and non-financial support.
 - Through special communication campaigns, the local authorities will bear the responsibility of increasing awareness of the potential benefits offer by the energy retrofits. Going further, they will inform the local house owners about the existence of support schemes and how they may access them.
 - The local authority counts with the highest degree of knowledge about the schemes since they were involved in the formulation of the agreement. This could be implemented as one-stop-shop, creating a central helpdesk, that can offer support to interested citizens during the grant application process.
 - The local authorities already have experience in controlling and registering the energy performance of buildings certificates. As a control body, they should confirm the compliance with the requirements established to access the financial resources. Depending on the model, those may be related purely to energy efficiency, or to the socio-economic situation of the applicant.
- Energy supplier/DSO: Acts as an intermediary between the public agent and the citizens. They can offer the up-front financial investment required, while the public body assess the application forms. Also, they can perform the energy retrofit, directly or through an ESCO company or other kind of installer.
 - Leveraging on the already established relationship with the consumers, the energy suppliers/DSOs can offer financial resources at an affordable cost. The repayment would be performed through an on-bill scheme, that is easier to understand and cheaper for the consumers than an alternative loan with a commercial bank. Alternatively, energy suppliers/DSOs that lack the necessary liquidity can use the services of an ESCO company or financing through a commercial bank, as they can access lower interest rates than individual consumers.
 - Energy suppliers/DSOs have the specific know-how about the status of the energy retrofit market and current technologies in use. Therefore, they should be

- in charge of implementing the measures related to the energy renovation. In case of a lack of resources and capabilities, they may use the services of an ESCO company.
- To reduce the bureaucratic inefficiencies, the energy suppliers/DSOs may represent the consumers and apply on behalf of them for the available public grants. This may help reduce the risks that energy suppliers/DSOs bear, as they would be the first to know when the grant application is accepted, and the associated funds would be transferred directly to them.
- Consumer: The key and principal agent involved in the process and main beneficiary of the model. Through it, they can access financing at a lower rate than the current offered in the markets and public grants for reducing the principal.
 - Each consumer has an established relationship with an energy supplier/DSO. The payments related to the financial costs for the funds offered up-front by the energy suppliers/DSOs may be performed through the electricity bill, as an additional fee.
 - The consumer must perform the renovation measures that are considered in each of the available package. Depending on the situation of each applicant, those may change.

Once the final agreement is reached, the model will be accessible for the consumers. To start the process, the interested home owner only would have to contact their energy supplier/DSO. To be able to proceed with the application, the energy supplier has to perform an assessment of the current energy performance of the dwelling. As part of the process, the energy auditor will recommend renovation measures that will appear in the resulting certificate. Those measures should include the ones considered in the Filling-The-Gap package. Based on those, the energy supplier/DSO will prepare a rehabilitation plan.

The energy supplier/DSO will be able to present the documents to the local public authorities. Considering the proposed measures, the municipality will give a pre-approved grant to the energy supplier/DSO. Using these advanced funds, it will be possible to start the renovation works and the risk that the energy supplier/DSO bears is greatly reduced.

After the retrofit is finished, a new energy performance certificate is issued. The projected savings are computed by comparing the ex-ante and ex-poste documents. The veracity of the documents is checked during the registration process. If the savings comply with the requirements, the public body will issue the rest of the grant to the energy supplier. If that is not the case, the energy supplier/DSO is required to pay back the pre-approved grant.

The rest of the principal invested in the energy renovation is repaid by the consumer through an on-bill scheme. The energy supplier/DSO holds a collection right for each consumer. The aggregation of those gives access to a green bond market, which lowers the associated financial risk and offers more possibilities for financial return.

Additionally, all consumers involved in the model would have to pay a contribution to a Guarantee Fund. In case of default by a consumer, the payment would be issued by the Fund. However, there is an associated risk with the dependency on the Guarantee Fund. To work properly, it requires a high volume of consumers from the first month of operation. Otherwise, the energy suppliers/DSOs could see the risk of non-performance from their customers as too high and they could limit the availability of the programme. This could be suppressed by obliging the energy suppliers/DSOs to pay an initial contribution to the Guarantee Fund, prior their accession to the retrofit model. The first payments consumers would make to the Guarantee Funds would be allocated to refund the initial contribution.

In this form, the model has several benefits for the involved agents. The public authorities can foster the achievement of the decarbonisation goals, as well as collect additional data regarding energy retrofits and the status of the residential building stock. The energy suppliers/DSOs receive financial benefits through the payment of interest for the investment, and can also benefit

from an improved reputation, as the support of energy retrofits can be considered a Corporate Social Responsibility measure. The consumer can afford an energy retrofit due to the accessible financial resources. Aside of the increased energy comfort and savings in the energy bill, the value of the dwelling increases.

On the other hand, there are several associated risks and additional costs. The municipalities will have increased workload, which will be related to the non-financial support of the model and the administration of the grants. The energy suppliers/DSOs would have to create new business units that would manage the relationship with the public authorities, consumers, ESCO and installers. Additionally, there is a possible conflict of interest for the energy suppliers, as their main business is selling energy (although other circumstances such as the electrification drive, or the potential to increase client's loyalty and differentiation or greening reasons may mitigate this risk). This conflict of interests is avoided in case of the participation of DSOs. Consumers' right to freely switch to another energy supplier will not harm the functioning of the model if the DSO is the main collector of the repayment for the renovations. DSO's are in this sense, more stable than energy suppliers, since repayments are linked to the meter instead to the individual energy supplier. Thus, if the financial scheme is articulated through the DSO, consumers will have no barrier to switching energy supplier, as the repayment is linked to the meter (and therefore to the DSO), and not to the energy supplier company. What is more, they would have to cope with the discomfort associated to the renovation works, a limited range - by the energy supplier/DSO - of available retrofit contractors and the liability to repay the financial costs and principal in a long timeframe.

Overall, the proposed model involves several key agents, that through collaboration schemes would allow to perform affordable energy retrofits. The introduction of on-bill solutions makes it simple for the consumers to understand the repayment method, while they benefit from the EE measures. The energy suppliers/DSO bear less risks than a commercial bank would have, as the European average for delays in payment of utility bills is only of 6% of consumers. In case of default by consumers, the risk is taken by a Guarantee Fund that can be sustained in time due to the cyclical contribution of all the users. The process of the energy performance of buildings certification is already established in all the countries of study and can be relied on as a control measure for the achieved savings.

- **Complementary offerings**

There is a transitional period until the works are finished and the savings materialised (and eventually, the grant is awarded) when financing is needed. Some energy suppliers may choose to finance themselves the customer's renovations, while others will use a financial institution for this purpose. In addition, commercial banks can also prefer to provide credit directly to the final user and not the energy suppliers. Finally, certain consumers may also prefer to bear the investment costs by themselves without the support of any third-party. Therefore, several combinations depending on the financial and technical capabilities of the stakeholders are possible, which explains different alternative arrows entitled "financing" in the **Figure 15**.

One important consideration is the balance between the size of the renovation programme and the transactional costs. Very often, the longer the value chain (the more agents crowding in) the larger the transactional costs, since each agent adds its own profit margin to the operation. That said, there are means to mitigate this issue, mainly through standardised and digitalised procedures that help to reduce transactional costs.

Banks can also tap into new sources of financing though issuing green bonds as explained in the previous sections of this report.

The guarantee fund will contribute to reducing the costs of financing for the banks backing the renovation loans.

- **Enablers and external stakeholders**

Government has an enabling role; they must launch the regulation needed to launch EEOs in the country ideally, optimally designed to align economic interest from energy suppliers with the need to cover deep renovations and renovations among vulnerable consumers.

9.3.2 Adapted model for “low hanging fruit” package

- **The Core Value proposition or how this model works**

In this model, the main difference is that once the consumer has applied to the grant, the municipality (if socio-economic criteria is met) provides as quick as possible a grant pre-approval. With this pre-approval, the energy supplier can start the energy renovations, similar to the general model. The type of measures included in the LHF will be normally directly delivered by installers, instead of ESCOs. Once the measures have been completed, the consumer must deliver the installer's invoice to the energy supplier, who can then claim the grant amount to the municipality, reimbursing for the costs of the renovation.

It is highly recommended to include a Guarantee Fund in the model, otherwise banks will not easily provide credit to consumers from the LHF. Additional added benefit for the society is the contribution to fight the energy poverty. Especially important is the design of the EEOs establishing the mechanisms that mitigate the already explained weaknesses of these schemes (unable to reach the lowest incomers, limited impact of the measures centred in superficial and isolated interventions). The rest of the model works as in the general model.

Acknowledging the additional economical effort of the vulnerable consumers and that their principal issues are different to the FTG consumers, the aim for this adaptation to the general model is no longer to achieve the highest energy savings, but the increase in thermal comfort of the participants. As well, it is recognised the need to lower as much as possible the economic burden associated with their participation in the programme.

As in the general model, the process is started when the consumer applies to join the programme at the energy supplier. The energy supplier presents to the consumer a list of qualified installers, that will assess the possible implementation of available measures. The proposed measures must be included in the programme, as explained in section 7.2.1. Once the measures are detailed with a budget, the energy supplier will send the application to the local public authority. The municipality will confirm that the consumer meets the socio-economic requirements to join the programme, that the measures to be implemented are within the expected limits, and that the budget does not exceed the €1500 cap. If everything is met, the local public authority sends a grant pre-approval to the energy supplier.

Once the measures are installed, the invoice is sent directly to the energy supplier, that transfers it to the local public authority. The public body controls and verifies that the execution of the works is in accordance with the proposed project, and if it does, they transfer the grant to the energy supplier. The consumer will only bear the financial costs and will be repaid through an on-bill scheme.

To achieve the highest protection of vulnerable consumers, the energy supplier will have a guarantee of being paid within a short period after the final approval of the grant (i.e.: three months). If the grant is not transferred in time, the energy supplier will be paid by the Guarantee Fund. This helps to reduce the risk of non-performance to zero. The financial costs liability of the consumers is limited to a short-time period, until the energy supplier received the invested financial resources. Additionally, the vulnerable consumers are excluded from contributing to the Guarantee Fund. This helps to move all the risk that the LHF has to the FTG, and thus achieving the goal of increasing thermal comfort, while protecting vulnerable consumers.